MARCH 1964 35 CENTS ICD

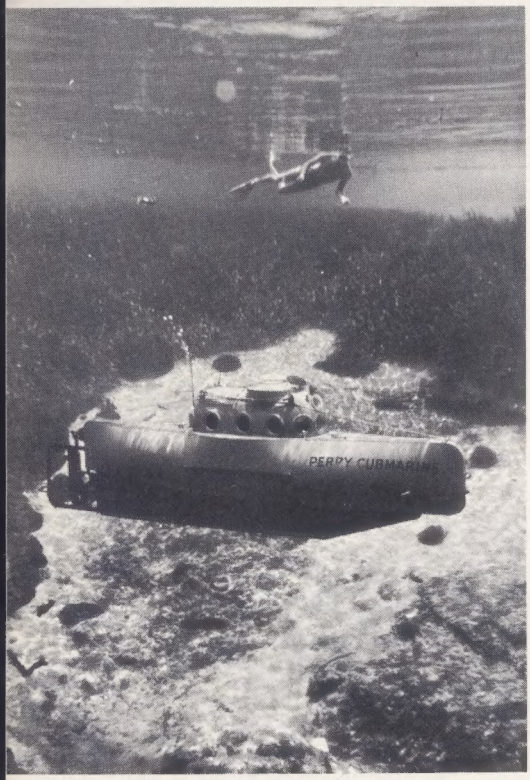
SCIENCE DIGEST

SOLITUDE

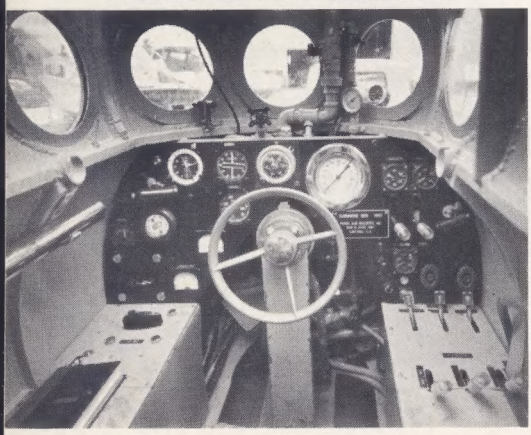
who can take it – and who can't

The race for surer, safer, cheaper contraceptives

REMEMBER? Cars that ran on Oatmeal and Molasses



Perry Cubmarine model PC3 is tested at Silver Springs, Fla. (above). Interior of the two-man PC3 is shown below.



Your own private submarine

With the increase in the number of private pleasure boats creating a traffic jam in lakes and harbors, there may be only one place left for civilian sailors to go—down.

And now you can do it, too, if you have about $29,600 to play with. That's the price of the cheapest model of a pocket-sized Perry Cubmarine, manufactured by Perry Submarine Builders, Inc., 2751 S. Dixie, West Palm Beach, Fla.

These highly maneuverable, battery-powered midget subs were designed primarily for oceanographic research and industrial uses such as inspecting underwater telephone cables. But it is not difficult to envision U-boat warfare among the sailboat set.

The two-man Cubmarines, the PC3s, are from 18 to 20 feet long, and light enough to be hauled on a trailer. They have a 20-mile operating range and a submerged endurance of up to eight hours. PC3's come in three models.

For bigger groups, there is the PC6, a five-man Cubmarine. The pilot is in one compartment and four passengers in another. Cruising range of this model is 500 miles or more on the surface; submerged endurance is eight hours or more.

Shades of Captain Nemo!

SCIENCE DIGEST

Twenty-eighth year of publication

Today's contraceptive pill is just a beginning. Every big drug company is racing to develop new pills and other birth control measures. For a preview of what this research will bring about, see page 86.

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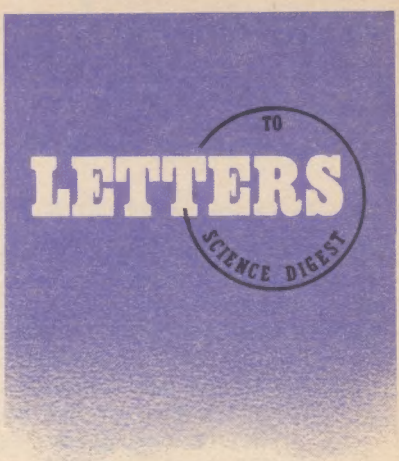


Scientific freedom

I found Hilbert Schenck, Jr.'s article ("Scientific Freedom—Hah!," Dec. '63) quite discouraging. He points out that exploding a nuclear bomb cannot be compared to the creative expression of an abstract artist, but there are many other areas of pure science which are not quite so ghastly.

I am willing to admit that pure scientists have certain responsibilities to society. But so do applied scientists. However, I find it extremely difficult to consider pure science as an evil field in which scientists work without regard for people. Is the search to understand the Universe as bad as all that? I don't think so.

So what if discoveries can be made in applied science without first being brought to light through pure science. This does not make pure science of lesser importance.

ROGER F. KRUEGER
Harper College
Binghamton, N.Y.

I cannot recall reading anything in *Science Digest* that has given me greater satisfaction than the article by Hilbert Schenck, Jr. How come it got past the censors?

C. P. SANDBECK
Trent, S. Dakota

What censors?—ED.

1964 Baby

After digesting your article on the "1964 Baby" (Jan. '64), I thought that it would be wonderful if our progenies would subsist to the mature age of 71. But what would be our future should nuclear holocaust begin between our country and "you know who"? I've heard many people ask the question.

J. WITKAVAGE
Seattle, Wash.

Good omen for Chunnel

Congratulations to you and James Winchester on an excellent Channel Tunnel story (Jan. '64). Maybe its appearance in that issue is a good omen that the Chunnel will turn out to be a "1964 Baby"!

JOAN S. REITER
Technical Studies, Inc.
New York, N.Y.

Democratic eugenics

Just because the Nazis abused eugenics, that is no reason to abandon it ("Science's Touchiest Subject," Nov. '63). We need a democratic answer to the stud farming methods of dictators. This can best be accomplished through self-supporting cooperative groups, not dependent on government hand-outs.

The question of what is the best human type is unrealistic. There is no one best type. Under any genuinely democratic eugenic program, there would be many different groups, each promoting its own type of excellence.

THEODORE B. DUFUR
Los Angeles, Calif.

The real meaning

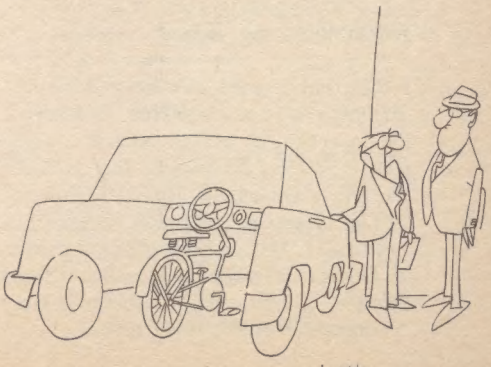
I think that in your article "The Christmas Syndrome" (Dec. '63) the real meaning of Christmas should have been mentioned. Christmas, although it is celebrated by almost everyone, is a religious holiday, marking the birth of Christ, for Christians. For the Christian it is not only a time of celebration but a time of realizing that this Christ was God's gift to the world.

ROBERT ALLEN
Ocean City, N.J.

Fritz Leiber has done a wonderful job of truth telling in his article "The Christmas Syndrome." It is a subject that has interested me for years.

ALBERT C. GILLILAND
Visalia, Calif.

"This is our luxury model at a compact price."



Nausea, nauseated, nauseous

I have been waging a lone crusade for years. Somehow, I thought I might win. Is the battle lost?

You may be nauseated, and the results of your nausea may be nauseous; but if I state that you are nauseous, you have good cause for a libel suit. (Unless, of course, you have been consorting with skunks, or working in a sewer!) I refer to "Is Any Anesthetic Safe?" (Aug. '63). [*The article stated "You do not get nearly as nauseous as you do after ether"*—ED.]

Speak of all the blood and guts you like, but let's keep our words in their right usage!

GRACE L. JAFFEE, R.N.
Phoenix, Ariz.

We are just sick to our stomachs over this error.—ED.

Easy to understand

I'd like to congratulate you for presenting a truly magnificent and accessible magazine. I love reading it because I don't have to be a specialist in many branches of science to understand what is written.

SERGIO FERNANDEZ
Tigris, Mexico

Worse than she feared

I find that I must terminate my subscription to your magazine because of the injection of certain articles in it. These articles have centered around the glorification of Russian women ("The Rise of Russian Women," Sept. '63), the elaborate nothingness of Gunnar Myrdal ("The Book that Started it All," Oct. '63) and "McNamara's Folly" (July, '63).

I am truly sorry that you are being guided into this sort of thing. Do you realize what you are actually doing? If you do . . . then it's worse than I feared.

MRS. CHRISTINE M. DRANE
Forest, La.

Medical missionary

I want to thank you for your fine magazine. I always enjoy "What's on Your Mind?" and "The Progress of Medicine." I also particularly liked "What Ever Happened to Lumbago?" (Nov. '63) and the article on Schweitzer (July '63). One day I hope to be a medical missionary.

RICCY WATTERSON
Chatham, Kent
England

Twain and St. John

It is interesting to note that Mark Twain ("Mark Twain Science Writer," Aug. '63) was not the first to write of global television. St. John, in the book of Revelation, chapter 11, verses eight and nine, writes of the same thing. The recent developments in satellite communication were the first steps toward fulfilling this 1900-year-old prophesy.

DAUN GARCIA
Cambridge, Wis.

Telepathy tests

I was intrigued by the item in "What's On Your Mind?" (Nov. '63) on research in the field of mental telepathy. I formerly thought that this use of the human mind was confined to science fiction.

ROBERT E. COOPER, JR.
Anchorage, Alaska

A restful quiz

by John and Molly Daugherty

We Americans have often been called a sedentary people. If this is so, we should at least know a lot about resting.

1. During sleep, muscle tone diminishes:
   a. Not at all
   b. Completely
   (c) To minimal levels

2. The most restful color for your walls is:
   a. Pearl grey
   (b) Pastel green
   c. Cream white

3. When you are tense, the least effective method of relieving your tension is to:
   a. Stay in bed
   b. Channel and deviate your stress (listening to music, chatting, etc.)
   (c) Generalize it by spreading it over your entire body (cutting the grass, scrubbing the floor, playing golf, etc.)

4. If you want to develop a motor skill, such as pursuing a target which changes its speed and direction, a constant practice period for five minutes should be followed by a rest period. Which length of rest period after the five-minute practice would be most effective?
   a. 5 minutes
   (b) 20 minutes
   c. 48 hours

5. If you have 20 working minutes to solve a logical reasoning problem, you will do better if you work:
   (a) Without interruption for the twenty minutes
   b. One minute at a time and rest one minute
   c. One minute and rest five

6. If a person who is tense can relax his body, either by retraining or by physical or chemical means, his fears and phobias, anxieties and obsessions will tend to:
   a. Remain the same, nevertheless
   (b) Disappear
   c. Intensify by contrast

7. Letting land rest or lie fallow for a growing season in dry regions:
   (a) Gives nature a chance to restore moisture to the soil
   b. Lets the soil deteriorate
   c. Has no effect

8. A body at rest will stay at rest unless it:
   a. Can rotate
   (b) Is acted upon by a force
   c. Is as light as a feather

9. Without a rest, your nose, accustomed to one odor:
   a. Is unable to detect a new scent
   (b) Is alert to a new scent
   c. Doesn't fluctuate in its ability to detect odors.

10. During all learning, there are plateaus when
    a. You do not progress
    b. You progress very little
    c. You slide back

Answers:

1 - c Muscles can experience almost complete rest—something they don't experience when you're awake. This relaxation is a vital function of sleep. You can die for lack of sleep faster than for lack of food.

The skeletal muscles that give your body speed and force, tire and need rest. The visceral muscles, however, do not tire and maintain a pace that matches their oxygen supply.

2 - b Asylums and mental-hygiene clinics paint their walls green to soothe the patients. Many hospitals have green walls for their restful effect.

3 - a Many endocrinologists believe you have a fixed amount of energy. When tension releases energy it is going to go to work in your body even if you are in bed. So it's best to divert your tension into other activities or try to spread it over your entire body.

4 - b A 5-minute practice period followed by a 20-minute rest period has proved most effective in research on motor skill development such as this. Muscular fatigue occurs fast in performing motor skills. Therefore, a short practice period followed by rest periods is better at first than massed practice.

5 - a You'll be more successful in solving a complex problem involving the learning and discovery of ideas and principles if you spend a long period of working time (massed practice), later following it with shorter periods of practice and rest (distributed learning).

6 - b Current thought of many psychiatrists indicates that the disturbing symptoms of a person who lives in a state of anxiety and tension will vanish if he can be trained to relax his body. Unhappy personal relationships are usually not the *cause* of tensions, but the *result* of it.

7 - a Growing crops in dry regions often takes more water out of the soil than nature can add to it in one season. Even land needs a rest! If dry land doesn't get this rest, the area may become a dust bowl.

8 - b This is part of Newton's First Law of Motion in physics—the Law of Inertia. Even a feather needs a force to move it.

9 - b Your nose grows used to an odor if it stays the same or increases slowly, but is alert immediately to a different odor.

The sensitivity of your nose fluctuates. For instance, you are more sensitive to aromas in late morning and late afternoon. Your sensitivity also depends on your sex and your age, as well as the time of day.

10 - a All learning curves show plateaus during which no progress at all is made. Yet such rest periods seem necessary for all of us.

Score yourself:

9 - 10 right—Rest on your laurels!
4 - 8 right—You apparently know there's more to resting than lying down.
0 - 3 right—Relax over your score.

Belly dance of a glow-worm

GULLIBLE German glow-worms have been making love to small electric light bulbs. The cause of all this misdirected affection is Dr. Friedrich Schaller, a zoologist who has spent the last three years looking into the love life of members of the species *Lampyris noctiluca* and *Phausis splendidula.*

The glow worms are, in reality, beetles. When mating time comes, the flightless females climb to a prominent place at night and turn on their light. Flying males see the beacon and rush to it. If a male does not spot the light quickly, the *Lampyris* female begins to wiggle her lighted abdomen, and the wiggle becomes more pronounced the longer she is alone. *Phausis* females never wiggle.

With diminutive electric light bulbs, Dr. Schaller made dummy females. *Lampyris* males were attracted only by lights that duplicated the females' light in size and color. Other color lights or lights of the wrong size or shape didn't interest them. But when the dummy female was wiggled, "her" success in attracting males was sensational.

Phausis males were far less choosey. They seemed to prefer a light that was bigger or brighter than normal, and they would go after a whole range of different colored lights. In nature, they often try unsuccessfully to mate with *Lampyris* females. This lack of male discrimination, plus the female's unimaginative wiggle-less posture, makes it harder for *Phausis* couples to get together. Perhaps as compensation, there are five *Phausis* males to every female.

Among both *Lampyris* and *Phausis* beetles, the males are a flighty bunch. In fact, the light of love is more important to them than the actual job of mating. A female switches off her light as soon as mating begins. But if the male sees another seductive light glowing in the vicinity, he may well break away and rush to the new glow.

P.I.P. photos

The birth of a chick

THE celebration of Easter predates the Christian era by many centuries. To the Anglo-Saxon tribes, it was the festival of the goddess *Eostre,* who represented light, or spring. From ancient Egypt and Persia came the custom of giving eggs as a sign of the new life of the spring. This little girl's Easter egg aptly fills its symbolic function as a sign of new life.

This little girl is lucky; the process of hatching usually takes place out of sight—in an incubator, or under a mother hen. First the beak is used to crack the shell from the inside. Then, after an enormous effort, the chick struggles out, looking very moist and un-birdlike.

Once free of the shell, the chick rests.

Dry, and fluffy, the chick looks more familiar.

SOLITUDE
who can take it and who can't

NASA

Being alone, really alone, can produce a sense of disembodiment, a "lust" for stimulus. How would you react? Here's how space-test volunteers did.

by Bruce H. Frisch

"I LOOKED down at my toes and thought they were probably six inches longer than I thought they were."

"Once the three meters became a wooden man with one meter his head, another his body and the other seemed to be his foot."

"I remember turning around once sharply and I thought somebody was perhaps moving there. I thought maybe it was a boat going by me."

These are the experiences of men who had just been overworked for 30 straight hours in the Space Cabin Simulator at Brooks Air Force Base. They are part of the mounting evidence that man's mind may be the most vulnerable as well as the most valuable equipment in a spacecraft.

Further evidence came from the 34-hour orbital flight of Astronaut L. Gordon Cooper last May. While streaking 100 miles above Tibet, Cooper claims he could spot individual houses. Atmospheric refraction could possibly cause such a freak, admits Dr. W. Ross Adey, director of the Space Biology Laboratory at UCLA's Brain Research Institute, but he suspects weightlessness. It may produce a euphoric feeling of well-being like skin-divers' "rapture of the depths."

Overwork and weightlessness are just part of the danger. In addition, an astronaut will be starved for sights, sounds and smells. He will be surrounded by a hostile emptiness, cut off from human contact and all else that shapes reality. "Eventually," says Dr. John Mann of New York University, "the earth man will tend to forget who he is, where he is going, and why he is going there."

Even before space flight, pilots at high altitudes felt a sense of disorientation, called "break-off." Some U. S. fighter pilots reported a feeling of being "unshackled," "like a king," or "wrested from the earth." Others felt fear, total isolation and uncertainty. Even at lower altitudes, pilots drift into break-off at night, while flying on instruments or above clouds.

Work in the Space Cabin Simulator showed that in many ways things were going to be tougher in a spacecraft than the hottest jet. Men who were excellent aircraft pilots couldn't take a 30- or 36-hour non-stop grind cooped up in the 46-cubic-foot cabin, much less a

seven-day stretch. Pilots who had learned to live with the danger of flying by believing in their own invulnerability couldn't depend on others. They emotionally accused persons outside the simulator of inefficiency and disinterest.

All had hallucinations

In the 30-hour routine, each volunteer was confined to his seat, got no word from the outside, heard only the steady hum of machinery and had to pay constant attention to a TV screen. Every person in the early experiments saw hallucinations. Their idea of time and space and even their own bodies became distorted. Two men had to be taken out—one after eight and the other after 22 hours.

Yet the chamber was safe and sound, set squarely on the ground. Throughout a test, every volunteer knew he could return to the world a few feet away at any time.

For added realism, a similar chamber was hooked to a balloon and floated to 101,000 feet in the Manhigh project. Colonel David G. Simons, who went through both the earth-bound and Manhigh tests, says, "The 'for keeps' nature of the balloon flight was inescapably present. During the (earthbound) chamber run, the only demand made of me that required a serious effort was to stay awake. By contrast, there was hardly a time during the balloon flight that I did not feel a sense of pressure and urgency."

This sense pressure deprived the balloonists of their ability to judge their own performance. As ground observers watched their alertness and accuracy wane, they continued to hear volunteers report they were doing fine. At one point, a balloonist's pulse zoomed to 140 beats per minute, but he remained completely unaware of it. Finally, the ground crew noted from automatic readings that the capsule temperature was nearing 100 degrees, but the balloonist wasn't aware of this.

For the starkest kind of realism, scientists have turned to real life, to the stories of Arctic trappers and explorers, shipwrecked sailors and prisoners in solitary. They show that loneliness can kill where the elements can't.

Died from 'aloneness'

Alain Bombard, a French physician who has studied shipwrecks, found that 90 percent of shipwrecked sailors died within three days from "aloneness." Psychiatrists point out, however, that such solitude is a forced aloneness. Antarctic stations offer conditions that are more like those in space flight. The crews there are volunteers who know they will be isolated for a certain length of time.

Reactions of the crews follow a cycle whether they are there three days or three months. Immediately after getting on the ice, there is a period of great anxiety. If a man is going to break down, he usually does it then. He will probably blame "fear of the unknown."

Stories of Arctic trappers, shipwrecked sailors, and prisoners in solitary show that loneliness can kill where the elements can't.

Next comes a long fit of depression, in spite of which the men do their work well.

Near the end, as the men anticipate return to society, the depression lifts. But work is neglected. Anxieties rise, and tempers too.

A common factor in these real or simulated experiences is the unrelieved sameness of life. Scientists have tried to isolate this factor by sensory deprivation experiments.

Dr. Donald O. Hebb, professor of psychiatry at McGill University, Montreal, Canada, outfitted volunteer students with translucent goggles to keep out patterned light and cardboard cuffs and gloves to keep the hands from feeling things. Each subject lay motionless on a bed in a closed room, into which a background hum was fed to mask outside noises.

An initial sleepy period was followed by restlessness, inability to concentrate, blank stretches and hallucinations. One student saw "a miniature rocket ship discharging pellets" that hit him in the arm. To some, the body took on a different form. A student would feel he had two bodies or that his head had parted from his neck or that his mind was a ball of cotton wool floating above his body.

A second approach has been worked out by Dr. John C. Lilley. He immerses his subject—either himself or one of a small group of fellow workers—in a tank of water inside a soundproof room. The water at 94.1 degrees eliminates any sense of temperature.

Everything is normal for about 45 minutes, then a "lust" for stimulus hits. A person may try to sneak movements of his arms. Rubbing the fingers together gives enormous satisfaction. If the person holds out against the lust, tension builds up inside him, and he may have to leave the tank. After tension subsides, it is replaced by a wave of "reveries and fantasies of a highly personal and emotionally charged nature." Around the three-hour mark, a person sees a "projection of visual imagery" such as luminous shapes or a tunnel glowing with blue light.

What causes hallucinations?

Some psychiatrists guess that hallucinations are caused not so much by a lack of sensory stimulation as by a lack of any meaning in the stimulation. Others feel inactivity is partly responsible.

One theory is that the mind keeps up a weak flow of thought within itself all the time. Ordinarily a hail

of stimuli from outside hides this. When outside stimuli are removed and attention is directed inward by the experiments, this internal current of thought is recognized in hallucination.

Recent research has created even more confusion. Experimenters at the University of Michigan and the University of Southern California have induced persons to have hallucinations within an extremely short time after starting a trial, sometimes within ten minutes. In some cases, this was done by telling the subject he would have such hallucinations and that they were entirely normal. Some subjects were also given a harmless pill and told it was a hallucinatory drug.

The relatively short space flights so far have been poor tests of sensory deprivation. But they are the longest tests yet made of weightlessness.

First weightlessness

Perhaps the first weightlessness experiment was carried out by a German scientist-pilot in 1928. He eliminated his sensory link to the airplane by anesthetizing his buttocks. He said it felt as if the plane had slipped away from his body.

Part of the weightlessness problem is similar. Gone are the cues weight gives us about the world. When we can't match the real world to the world as we think it ought to be, we may become disorganized and disoriented.

Continued over a long period, weightlessness may cause deterioration of brain cells, some U.S. and U.S.S.R. neurologists fear. For these and other reasons—possible loss of bone calcium or deterioration of the circulatory system—a spaceship may have to be spun to create an artificial gravity.

The problems of spinning

Spinning introduces its own set of problems. A possible spinning space station would be shaped like a bicycle wheel. Men would live in the tire-shaped portion where the outer wall would be the floor.

As an astronaut started walking in the direction of spin he would feel himself grow heavier. When he turned around and walked the other way he would feel lighter. He might shake his head in wonder and suddenly feel the room tilt, or feel himself tilt. His eyes would tell him it wasn't so.

Already feeling bedeviled, he might lose his temper when everything he dropped fell on a slant and rolled to the outside walls.

Designers could install curved floors. Then something that looked as if it should roll to the center would hang at the edge.

Research in one of the several orbiting space labs now planned should reveal how much of this apparent nonsense a man can take.

Drawing on present knowledge, scientists suggest the following measures for keeping astronauts sane.

Pick the right men. Test pilots

In the isolation of space, men "might become estranged from their families and friends, forget their country, or have delusions of power."

of hot planes have conquered some of the same stresses and dangers that will have to be faced in space. Psychiatric probing can uncover those defenses that worked in the air but won't work in space.

Train them. Obviously they will have to know what to expect.

Overtrain them. They will then make the right moves when the going gets rough.

Give them something to do. Activity is one of the best ways to survive isolation. But meaningless chores are almost as bad as idleness. On the other hand, one mustn't overload the men. This causes errors, missed signals and fatigue.

Give them company. With a companion, it is possible to rotate the work periods. Man has a short attention span, no matter how important the job. Three may be a crowd. Two usually combine against the third as a way of establishing order. The third has to go along, or else there's trouble.

Supply new sensations. This helps beat sensory deprivation. After spending five months alone in Antarctica in 1934, Admiral Richard E. Byrd said, "I don't think that a man can do without sounds and smells and voices and touch, any more than he can do without phosphorus and calcium." Movies and music would relieve the monotony.

Keep in touch with the men. Spacemen may forget who they were on earth and what they did, says Dr. Mann. "They might lose interest in the original goals of the mission and decide on new ones. They might become estranged from their families and friends, forget their country, or be seized by delusions of power, and establish plans to utilize their position in space for obtaining special concessions, treating their own country and friends as enemies." The impersonality of space may brainwash them, Dr. Mann suggests. They might then fill the void with their own goals. Again, movies and music would help, along with books, radio contact and talks with their families. But though such devices may postpone trouble, they will not forever, Dr. Mann warns.

What to adjust to what

The whole idea of comfortable, familiar surroundings might be called the homey approach. It means adjusting the environment to suit the man.

A different school of scientists presses the opposite approach—adjust the man to suit space.

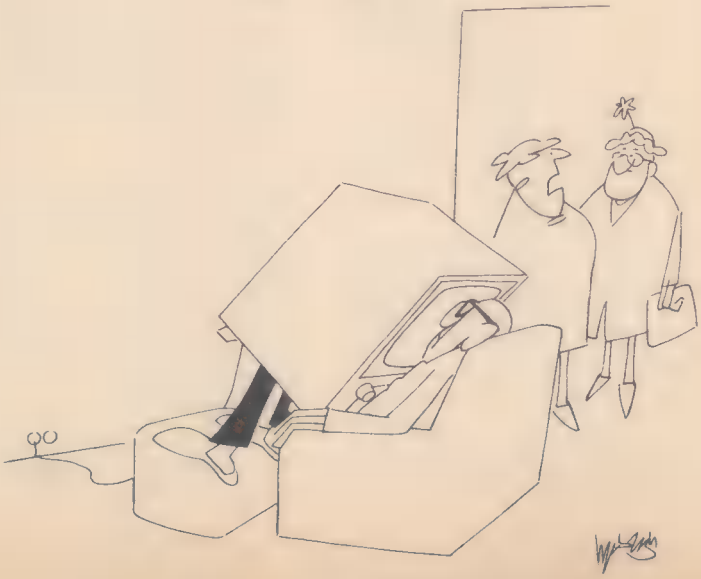
The blood of a man changed to

suit space would bypass his lungs. Instead it would be led out of his body, through an automatically controlled oxygenator and back to his heart. Drugs automatically fed into his veins would keep him awake, put him to sleep, control his heart and protect him against radiation. He would be fed intravenously or by a tube up his rectum. He would be a lump of flesh at the end of various tubes, pipes and drug pumps.

For emergencies, psychiatrists suggest some last-ditch measures. The crew may be able to help themselves by forming a group analysis circle, or each man might be given his own psychoanalytic computer to which he could go for advice. Should these measures fail, a strong-room might have to be provided for an astronaut who succumbs to space. An alternative would be a drug to knock him out for the balance of the trip. In fact, an astronaut may be knocked out for most of the trip to circumvent the whole problem of guarding his sanity. Drugs or self-hypnosis are two ways put forward; hibernation in cold storage is a third.

Research continues, but much remains to be learned about the human mind if a spacecraft isn't to become a padded cell. "The critical problem areas which threaten man's effective conquest of space are largely psychophysiological," claims Colonel Bernard E. Flaherty, past chief of neuropsychiatry at the Air Force Aerospace Medical Center. Now that the engineering barriers to space travel have been broken, says Col. Flaherty, man is the "weakest link."

" . . . weak picture tube."



Shadow of the invisible

WHEN you warm something on the stove, all you are doing is making the molecules move faster. The higher the temperature, the faster the molecules jump around. This jiggling, bumping motion that never stops has a familiar name: heat. (See page 76).

When some air is heated, the molecules bump each other harder, and so they keep farther apart. The heated bubble of air swells up—it expands and floats upward. Scientists call this updraft of heated air convection. Although air itself cannot be seen, you can watch convection by doing an experiment:

Place a small flashlight, such as a "pen light," on a table at one side of a darkened room, and shine it on the opposite wall. A plain, light-colored wall is best.

Light a wooden match and hold it about a yard from the wall. You will see a clear shadow picture of the hot gases steaming upward from the match flame.

The heated gases, being thinner than the air around, not only go upward but also bend the light that comes through them. This makes a shadow that you can see. The same idea is used by engineers in tests to show the airflow around airplanes.

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What men and women should know about baldness

by William R. Vath

Hair is a compelling subject to many people, and the sight of it falling out is enough to cause hysteria in some. A few years ago physicians said about the only thing you could do about baldness is get a wig. That is no longer true. Here's what science has discovered.

THE first known written medical record, the 4000-year-old Ebers papyrus, contains a prescription for baldness. This ancient remedy was, and is, quite as effective as most of the modern over-the-counter preparations. If you'd like to try it, here's the formula: Take equal parts of the fat of a lion, a hippopotamus, a crocodile, a goose, a serpent, and an ibex and apply liberally to the bald pate. The result is guaranteed to be the same profuse growth of hair which is so characteristic of the crocodile, the hippo, and the serpent.

Although thousands of cures for baldness, or *alopecia,* as it is known medically, have been touted in the last 40 centuries, they all have one element in common—they fail to grow hair.

Baldness is a kind of problem that breeds quackery. Ordinary baldness is not a disease but a cosmetic disturbance. Legal authorities,

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therefore, haven't as much chance to take action.

Another reason for the quack's success is the average person's preoccupation with hair. Although human hair serves no essential biologic function, it is the focus of compelling interest cosmetically.

Before examining the many types of baldness and the remedies medical science has discovered in the past few years, let's find out what hair really is.

Hair has been described as a substance composed of 50 percent carbon, 21 percent oxygen, 18 percent nitrogen, 6.7 percent hydrogen, and the rest a mixture of sulfur, vanity, and despair. Actually, it is a nonliving structure composed principally of a form of keratin, a horny type of tissue which is the main constituent of skin, nails, and the organic matrix of tooth enamel.

The average adult scalp has about 120,000 hairs (about 1000 to the square inch). Blonds have about 140,000, redheads about 90,000, and brunets about 110,000.

Easy come, easy go

Hair grows at a tremendous rate. The cells in the hair roots reproduce every 24 hours, thus sending forth a hair shaft that grows half an inch a month. During a lifetime (providing you don't become bald) you will produce about 15 pounds of hair.

Hair grows in cycles. Many hairs grow for four or five years, enter a resting phase for about three months, then fall out. After this, a whole new hair shaft is formed. Ordinarily, about 90 percent of the hairs are in the growing phase and 10 percent in the resting phase.

Normally, you lose 25 to 100 hairs a day. These are shed from follicles (the skin depressions containing hair roots) in the resting state. Such hairs are less firmly anchored and are lost from combing, brushing, and shampooing.

Upsetting the balance

They are replaced, however, because the scalp starts growing new hairs every day. The rate of loss and replacement varies from person to person and from time to time in the same person. Only when the rate of hair loss exceeds the rate of new growth are thinness and balding apparent.

What upsets this careful balance of nature? For the most common form of baldness, male pattern baldness, Dr. Eugene Van Scott, head of the Dermatology Service of the National Cancer Institute, expresses the opinion of almost all dermatologic authorities when he puts the blame on three factors: sex, age, and heredity. "And we can't do a thing about any of these," he says.

Ordinary baldness (male pattern alopecia) has many characteristics that make diagnosis simple. The telltale feature is the pattern of hair loss. It may begin at the crown, but more often the hairline gradually recedes at the temples. Eventually, the frontal hairline assumes the shape of the letter M. By this time,

New, But Limited: Hair Transplantation

There have been some recent new attempts to try to help ordinary baldness with ■ surgical technique called hair transplantation. This procedure can be done in the doctor's office and requires only ■ skin biopsy punch and a local anesthetic. Small grafts are removed from the sides and back of the scalp, where hair usually persists long after the top is shiny, and transplanted in bald areas. The grafts are carefully spaced on the bald areas so that as the hair grows it can be combed to cover the surrounding bald scalp.

The skin in the bald area is prepared with a punch, and a transplant containing eight to 12 hairs is placed in each excision. As many as 20 transplants can be made in a one-hour sitting.

The hairs in the grafts fall out in about a month. Two months later, the hair roots produce new growing hairs. These hairs will follow the growth pattern and hair loss characteristics of the donor site; thus if baldness is progressing rapidly, the procedure may be of little value.

The donor sites are left alone and heal within two weeks. Because of shrinkage of the defects at these donor sites during the healing process and coverage from overlying and surrounding hair, 100 to 150 transplants can be obtained without creating apparent bald spots. However, these hairs do not regrow; the total number of hairs on the head remains the same.

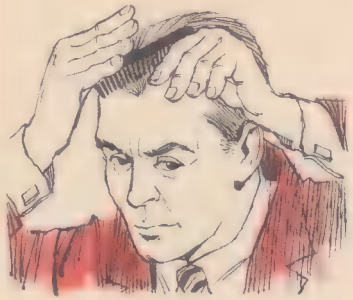
In some instances the entire crown has been treated this way, and in others a border has been created around the front edge of ■ toupee to hide the undersurface and obtain ■ more natural look.

Hair transplantation is, without question, a time-consuming procedure, and it has raised some mild controversy. There's no question of its helpfulness in selected cases, for the transplanted hairs continue to grow even after more than five years. As yet, however, the cosmetic results are not really satisfactory for most patients who have large areas of baldness.

For this reason, dermatologists are cautious in recommending transplantation. As one physician put it recently, "It is an available procedure, but it may be somewhat disappointing to the patient."

Dr. Albert Kligman, of the University of Pennsylvania's Department of Dermatology, discussing baldness in the **Southern Medical Journal**, asked this question: "Should we concern ourselves with this benign, trivial condition to the extent of surgical correction?

"Why not," he went on, "if the patient earnestly requests it and has an otherwise healthy personality?" However, he adds, "Surgical therapy of the excessively neurotic should be avoided, since their visions of a new, beautiful self cannot be fulfilled."



Two out of five of all Caucasian men will suffer from male pattern baldness. This usually begins in the late 20's or early 30's.

the hair is thinning at the crown, and the thin area progresses forward until it joins the denuded area in front. In extreme cases, only a fringe of hair is left around the base of the scalp.

All males tend to lose some scalp hair in the course of time, although some reach old age without any thinning becoming apparent. It has been estimated that two out of five of all Caucasian men will have male pattern baldness. It usually begins in the late 20's or early 30's, but in some individuals with a strong family history of baldness, balding becomes obvious shortly after adolescence. The prognosis for such cases is poor; they will usually be quite bald before their 30th birthday.

Somewhat similar balding, though less complete, has always occurred (but may be getting more common) in women as well as in men, but the feminine type proceeds according to a different pattern. Instead of a receding hairline in front, women suffer a diffuse thinning over the crown and front of the scalp. This rarely progresses to complete baldness, though it may approach it in very old women. The victims may have a family history of "thinning" of the hair in female ancestors.

When treatment works

For other forms of baldness, there is a great variety of causes: infections, systemic diseases, drugs which have toxic effects, mechanical stress, friction, and radiation.

Infections which cause loss of hair can be fungal (*e.g.*, ringworm of the scalp), bacterial (*e.g.*, staphylococcal or streptococcal), or viral (*e.g.*, herpes zoster). Early diagnosis and treatment is important; otherwise, the hair loss may be permanent.

Systemic diseases which can lead to baldness include allergic and other reactions to drugs, advanced diabetes, influenza, scarlet fever, syphilis, pituitary disorders, leukemia, and cancer.

Toxic effects of drugs and chemicals have also been blamed. Certain substances, when ingested or applied to the skin or hair, can result in loss of hair. Permanent waves, when inexpertly used, have destroyed hair follicles, but with the products in use today there is virtually no risk.

Mechanical stress, another cause of hair loss, is often inherent in certain hair styles. Prolonged traction by tight pony tails, braids, curlers, comb rollers, barettes, bobby pins, or combs can literally pull hairs out by the roots, and eventually can impede regrowth to such a degree that transient or even permanent baldness will occur. Brushes with square-cut nylon bristles have also been implicated.

Baldness and radiation

Radiation from X-rays, radium, radioisotopes, A-Bomb explosions, or atomic accidents can cause temporary or permanent baldness.

Loss of hair is quite common toward the end of pregnancy, after delivery, and during menopause. In most cases, the majority of these hairs will regrow. But it may take several months.

Many people worry that dandruff might lead to baldness, but there is no known cause-and-effect relationship between the conditions.

The cause of some forms of baldness is unknown. One relatively common type is *alopecia areata,* in which bald patches develop abruptly, usually on the scalp but occasionally on the beard, eyelashes, the underarm regions, and on any other area of the body. The sudden onset is especially disturbing. A person may awaken one morning to find small heaps of hair on his pillow and one or more circular bald spots on his scalp.

Spontaneous regrowth

The condition may not progress beyond the initial area, but more often other spots form on distant or adjacent parts of the scalp. The baldness may spread until the whole scalp, the eyebrows, and the lids are denuded and even every other body area loses its hair.

Fortunately, in most cases of "patchy" baldness, the hair will regrow spontaneously without any treatment. Single patches usually regrow in a few months. The first regrowth is fine, colorless, and short. This is replaced shortly by a new growth of thicker and healthier hair which is also colorless. In time, a third regrowth will usually occur. Loss of hair may be permanent, especially when large areas are affected. The complete cycle takes one to two years, but recurrences are common.

Although alpecia areata is self-limiting and usually self-curing, therapy is indicated in some patients. In selected cases, injections

Mechanical stress can cause loss of hair, and prolonged use of curlers, comb rollers, barettes, etc., can literally pull hairs out by the roots.

of insoluble sterois suspensions directly into the scalp have produced some hair growth.

Aside from the obvious advice—"buy a wig"—there are several things you can do to improve your appearance when baldness is not due to a disease:

Don't worry

1. Don't feel sensitive about your hair. Excessive worry, nervousness, and anxiety can actually cause more hair to fall out. Remember that a person can lose 30 to 35 percent of his or her hair without an obvious cosmetic defect.

2. For thinness on top of the head, men can get away for a few years with a lower part and hair combed over the thinning area. Women can try an upswept hairdo.

3. For a widening hair part, change to a pompadour or change the location of the part.

4. Women can cover a receding forehead hairline with bangs of many different styles.

5. When areas of regrowth are unpigmented, coloring agents can be used.

6. When all else fails, and you get discouraged, remember Don Herold's succinct comment about baldness: "Anyway, it's neat."

TWENTY narcotic addicts are regularly receiving a stable maintenance dose of a drug similar to heroin, under the direction of the New York State Mental Hygiene Department. The purpose of this experimental project is to determine whether a "reasonable number of addicts can live a satisfactory, normal existence under such conditions," says Dr. Paul H. Hoch, New York State Commissioner of Mental Hygiene.

Inventor of the month

World's first automatic guided missile launcher

Sverre Kongelbeck, former athlete and university professor, is the designer of the first fully automatic guided missile launcher.

A FORMER heavyweight boxing champion has armed the U.S. Navy with an extra punch. He has presented it with the Mark 11, the world's first fully automatic guided missile launcher, already installed on a score of destroyers.

Science Digest Inventor of the Month is Sverre Kongelbeck, supervisor of engineering at the Johns Hopkins University Applied Physics Laboratory, Silver Spring, Md. There he is known as Steve ("because they had trouble pronouncing my first name").

Steve has been amateur athlete and university professor in his native Norway, builder of steel mills in Africa, and designer of ships and dams in this country. Before joining the Johns Hopkins staff a dozen years ago, he was engineer in charge of construction at the bevatron (nuclear accelerator) operated at Berkeley by the University of California.

The Mark 11 has a turret with two launching arms. It handles Tartar medium-range anti-aircraft missiles, as many as 50 of which can be stored in a magazine below decks. The launcher can send up a two-missile salvo every 20 seconds or less.

Control can be exercised from a console below decks or on the bridge. Activation from a standby condition needs less than a minute. Under the direction of radar, the launcher takes automatic aim at an enemy aircraft, glide bomb or missile. When a button is pressed, it brings a Tartar up from the magazine and fires.

Kongelbeck worked two years steadily on the launcher, during the day at the laboratory and evenings and weekends at his home. Besides Patent 3,113,486, which he recently

obtained for the Navy, he got an earlier one for the Tartar's folding fins. The missile, which seeks its own target and can carry either a conventional or a nuclear warhead, is about 15 feet long and 1 foot in diameter.

It was in 1928, when he was 22 years old, that Sverre Kongelbeck retired undefeated as Norwegian national amateur heavyweight boxing champion. In swimming, his second major sport, he won many interscholastic and national honors. In 1930 he captained the Technical University of Norway's ice hockey team, which won the state championship.

Nowadays he lives with his family in Silver Spring, and confines his athletics to golf. —*Stacy V. Jones*

INVENTIONS
PATENTS
PROCESSES

If you swallow a pin . . .

A NEW medical instrument being tested by General Electric Research Laboratory, Schenectady, N.Y., promises the easy removal of objects like pins and tacks, if you should ever swallow them accidentally.

Until now, the removal of a swallowed pin or tack has meant the danger of a perforated stomach or intestine. G.E.'s new powerful Alnico magnet, which can be switched on and off inside the patient, overcomes the danger.

The usual procedure, previously,

A switchable medical magnet, used for retrieving objects swallowed accidentally, is able to turn a pin in a person's stomach, before removing it.

was to use a simple permanent magnet attached to a flexible cable, inserted down the patient's throat until the magnet came in contact with the swallowed object. Then both the magnet and the object were withdrawn together. The procedure was followed on a fluoroscope.

But in the case of an open safety pin, for example, if the magnet grasped the pin with the sharp point projecting upwards, the pin could puncture the tissues of the stomach and esophagus.

G.E.'s answer has been to develop a magnetic device that can be turned on or off at will. In this way, the device can be connected with the right end of the pin before the current is applied and the pin then safely turned in the stomach to be removed blunt end first.

The device is about 30 inches long and one-quarter inch in diameter. It consists of a stainless steel cable enclosed in a plastic tube, with an iron tip on the end. When the permanent magnet at the end of the control cable is slid forward until it touches the iron tip, the tip becomes magnetized. When the permanent magnet is retracted into a magnetic shield, the tip loses its magnetism.

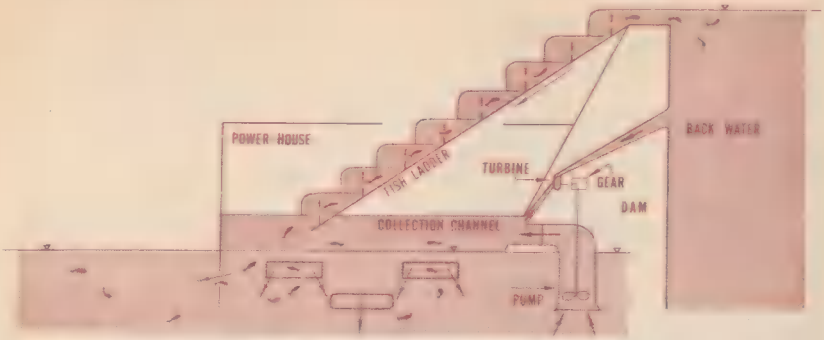
The older type of magnet had another disadvantage. There were regions of the stomach that it could not reach. G.E. has come up with an answer to this problem too. It has developed a "steerable" magnet consisting of a stainless steel control cable enclosed in a plastic tube. A spring hinge is located near a permanent magnet at the tip of the device so that, after it has been placed in the patient's stomach, a physician can maneuver the magnet upward simply by pushing down on the control cable. The magnet can then be rotated to any desired position, reaching previously inaccessible parts of the stomach.

With the new procedure, objects can be removed in two or three minutes. No anesthesia or hospitalization is required—the patient can go right home. The instrument is simple enough so that a general practitioner can use it without having to have special training.

Driver's spy-in-the-box

The Drivometer is a new mechanism designed to test a driver's skill on the road. It has ten counters linked to the speedometer and basic car controls, yet is compact enough to fit a standard glove compartment.

A Drivometer fitted to the glove compartment gives this young lady a better chance to evaluate her driving skills.



Schematic drawing shows how fish will be water-lifted over the John Day Lock and Dam Project so that they can continue their life cycle and not be cut off by the dams.

The electromechanical device was developed by the University of Michigan Transportation Institute with funds provided by the Ford Motor Co. The manufacturer is Rockwell Manufacturing Co., The Rockwell Bldg., Pittsburgh 8, Penna.

The Drivometer gives a minute-by-minute measure of both the driver's skills and the motion of the car. It is expected to be useful in driver-licensing road tests, in teaching drivers, and in traffic engineering.

It works by recording the driver's actions and noting impulses and responses. One pair of counters records the steering-wheel reversal rate, minute-by-minute. Another pair records auto speed changes in miles per minute. Others log a cumulative count of steering-wheel reversals in a test run, watch over accelerator changes, and record the time the car is in motion, total speed changes in miles per hour, brake applications and total trip time.

Fancy new salmon hoist

Plans for the most modern of fish "ladders" have been included in the construction plans for new, large power dams on the Columbia River between Oregon and Washington. The "ladders" will enable salmon to continue their normal migrations and trips upstream to spawning areas by passing over the dams. The dams in the area will constitute the largest hydro-power stream system in the United States.

The fish will be drawn to watery ladders to lift them over the dam by large vertical pumps called Fish Attraction Pumps manufactured by Worthington Corp., Harrison, N.J.

for the home

Drinking water anywhere

A portable Water for Living Flask now offers a way of producing 6 gallons of safe, pure drinking

water from any questionable water source, except salt water. It is recommended by its manufacturer, General Ionics Corp., 101 Terence Dr., Pittsburgh 36, Penna., for homes in flood danger areas and in hurricane belts, as well as for hunters and hikers who may find themselves far from a safe water source. It will also remove radioactivity from water.

The flask is compact and light enough to be carried in a jacket pocket. It can be stored indefinitely without deterioration or depletion of contents. With it comes a foil packet containing purifying material. To use, the contents of the foil packet is emptied into the flask. The flask is then filled with water from the questionable source. It takes five minutes for the Ion Exchange and purifying action to take place; the water is then safe for drinking. One resin charge will treat the contents of the flask 48 times. The Ion Exchange Resin will change color (from dark blue to light yellow) when exhausted.

Compact water-purifying kit makes it possible to purify all water but salt water, at home or out-of-doors.

Make your own 'antiques'

For do-it-yourselfers, a kit that enables the user to give his furniture that antique look is offered by Martin-Senour Co., 2500 S. Senour Ave., Chicago, Ill.

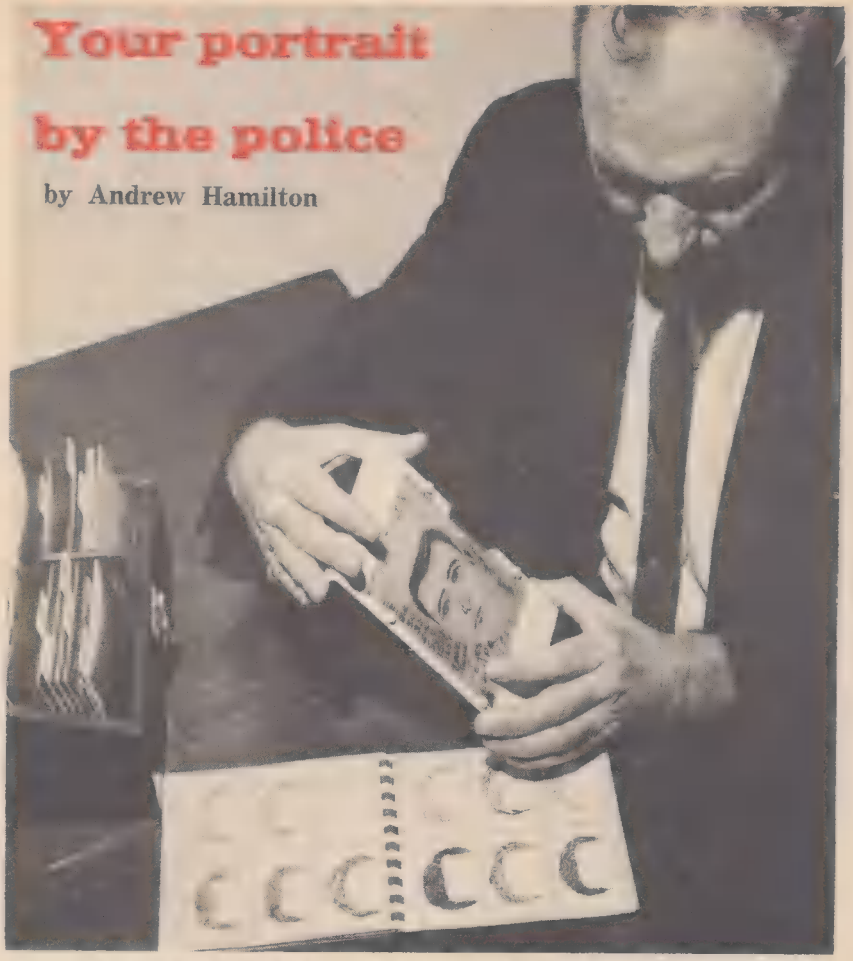
Six glaze color tints are offered in the Provincial Color Glaze Kit: Provincial Pink, Medici Blue, Old World Olive, Spanish Gold, Roman Red, and Antique White. One labor-saving advantage is that you don't have to remove the old paint on the piece of furniture first, no matter what condition it's in, says the manufacturer.

First the piece of furniture is painted with the off-white Antique Undercoater supplied in the kit. Next a coating of the translucent Provincial Color Glaze is brushed on. Then it is wiped with cheesecloth to produce subtle shadings. A pale tint of color covers flat surfaces and high points of carved designs, while deeper color remains in crevices of carved areas, emphasizing design.

The kit contains enough material to refinish one chest or two chairs, and a book of instructions, "Antiquing Made Easy," is included. The glaze can be worked many ways for special effects, says the manufacturer, and textured patterns may be produced by wiping, brushing, spattering, and stippling.

Your portrait by the police

by Andrew Hamilton



Using slides from the Identi-Kit, a police official prepares a picture.

The police have 62,000,000,000 portraits in a box 10 inches long and weighing only [redacted] pounds. Here's how it's done.

POLICE in 600 American cities, and around the world from Hong Kong to the Gold Coast of Africa, have an amazingly accurate likeness of you.

Your face and 62,000,000,000 others (20 times the world's population) nestle compactly in a black walnut box—weighing only six pounds and measuring 10 inches

Any police department in the world with an Identi-Kit can assemble a suspect's portrait in minutes after being telegraphed the coded numbers of the slides.

long, 4¼ inches wide and 7 inches deep.

It's the Identi-Kit system developed by Hugh McDonald, chief of the civil division of the Los Angeles Sheriff's Department. First put into use in 1959, it has already solved a number of hard-to-crack crimes all over the globe. Police officers call it "the greatest practical aid to identification since the fingerprint."

The easily-portable Identi-Kit contains 544 clear plastic slides—each bearing a single facial characteristic or accessory. Every slide is coded by a letter or a number. The slides are divided into 12 categories:

26 age lines
25 beards and mustaches
52 chin lines
83 eyebrows
102 eyes
4 facial tone cards
10 glasses
134 hair lines
30 headgear
37 noses
40 lips
1 scar grid

When the slides are properly assembled into a plastic "sandwich," police have a picture of the suspect. This is a marked improvement on former methods of identification in two ways: it is often more accurate than a drawing by an artist, and it is faster than looking at thousands of photos in a mug book.

Here's how it works:

A woman strolling through the city park at dusk is knocked down and robbed of her purse. When she reports the incident to the police, she gives basic information on the man: age, color, height and weight.

The interrogator asks her to describe the man's face and goes to work with the Identi-Kit.

"I saw him only for an instant," she says. "But he had a thin nose, a small mouth and little, squinty eyes." She searched her mind for a moment. "There was something else—oh yes, blond, crew-cut hair."

As she describes the man's features, the officer, working with the plastic slides, assembles a full-face, eye-level likeness of the suspect.

"Is this the man?" he asks.

"Well, yes," she says, "except the mouth was smaller."

Corrections are made and a fairly accurate picture of the assailant is available in minutes to any law enforcement agency in the world that possesses a similar kit. Coded numbers on the slides can be flashed by telegraph or cable around the world.

Much of the value of the Identi-Kit system lies in the "negative approach"—the elimination of all suspects that don't fit a witness' de-

scription. In most cases, the field of suspects is narrowed down by as much as 90 percent.

The handy little identification device was conceived by Chief McDonald when he was a detective on the Los Angeles Sheriff's robbery squad more than two decades ago.

"I worked a lot of robberies then," he said. "And I came to the conclusion we had to develop some method of reducing a verbal description to a picture.

"Sure, we had police artists. But they were used only on big cases and the process took a lot of time. We needed a simpler, quicker way."

Before he could test his idea, McDonald knew that it would require many photos of human features—hairlines, eyes, noses, mouths, chins. On his own time he shot pictures of thousands of faces, enlarged their features and sorted them into types.

But two things in the early 1940s halted the development of the idea. He ran out of money, and the bombing of Pearl Harbor put him into an Army uniform to serve in Europe and Africa.

In the mid-1950s, however, officials of the Townsend Engineering Company of Santa Ana, Calif., suggested to McDonald that he revive his quick identification ideas. They worked out a deal and full-scale development of the Identi-Kit began.

Approximately 40,000 photos were shot and collected of Caucasians, Negroids and Orientals, as well as many of the subraces. More than a year was spent in measuring

The Identi-Kit manufacturers use comparisons like those above, drawn from actual police files, to show the effectiveness of their product in assembling a picture of a suspect from a witness' description.

average spans between features—nose to mouth, mouth to chin, etc.—to establish a standard pattern on which the features could be assembled.

When all was set, McDonald's boss, Sheriff Peter Pitchess, offered to put the first Identi-Kit to a practical test. It worked so well that the Los Angeles Sheriff's Department has added ten more to its criminal identification division.

Today this new system of identifying criminals is used all over the world. When Scotland Yard became interested, McDonald himself accompanied the demonstration team. Today 28 Identi-Kits are being used

by the British police organization.

Here are some typical cases in which Identi-Kit helped solve the crime:

• In Cleveland, Ohio, a "bushy-haired" man attempted to assault a 13-year old schoolgirl, and then a 15-year old. Several nights later he followed a woman and her daughter out of a theater and then trailed them in a car to their home. The woman jotted down a license number and reported it to the police. When picked up, the "bushy-haired" suspect seemed to have an air-tight alibi. But he closely resembled the Identi-Kit likenesses described by all four women and soon confessed.

• In San Diego, Calif., two men robbed the Bank of America at gunpoint and escaped with $61,942. A picture of the two suspects was developed by the Identi-Kit technique and published in many California newspapers. Next day the police received two telephone calls naming one of the suspects, who was quickly taken into custody.

• In Reading, Penna., police were puzzled over the murder of a housewife in her home. But when Identi-Kit produced a likeness of a straw-hatted man seen near the property that day, several detectives named him as a suspect in other crimes.

• In London, the body of a woman clerk was found on the floor of a dimly-lit curio shop with an intricately-embossed Indian dagger through her heart. The owner of the shop described a swarthy, thin-faced young man who had been talking to the clerk the day before. An Identi-Kit picture distributed to London bobbies led to the capture of the man, who said he had intended only to rob but instead had panicked and murdered.

Identi-Kit is not sold, but is leased. The fee ranges from $10 to $25 per month. "It's worth the price if it catches only one criminal a year," said Capt. H. V. Hickman of the Houston, Tex., police department.

Law enforcement officers are given a special 20-hour course on how to use the kit and how to interrogate witnesses. When they become experts, they can assemble a likeness from a verbal description in 20 minutes.

"Obtaining correct information from a victim or a witness calls for highly-developed skills," pointed out Chief McDonald. "Some witnesses can't remember details and an interrogator must apply a special line of questioning in order to probe the subconscious.

"Then there are reluctant witnesses—those who may be resentful over a recent traffic ticket. The interrogator must know how to draw out these reluctant types.

"And finally, there are witnesses such as children who might describe a suspect only five feet tall as 'a big man.' An interrogator must be aware of such pitfalls."

Today, Identi-Kit has passed well beyond its experimental period and seems to be here to stay. "It will never replace hard work and brains," said one veteran police officer. "But it sure is a big help!"

Report on the electric toothbrush

by Bruce H. Frisch

"Too lazy to brush your own teeth?" So say people when they hear you've got an electric toothbrush. But clinical studies indicate the new gadget may bring better dental health as well as convenience.

THE electric toothbrush is no longer just a gimmick. You may find yourself forking out close to $20 for one, convinced that the dental health of you and your children depend on this addition to the list of electrical gadgets.

Manufacturers have been sponsoring clinical tests hoping they will prove the electric toothbrush helps prevent cavities, promotes healthy gums and is easier to use for the young, old and handicapped. Results are wrapped in glossy brochures and fired off to dentists. If the tests are convincing enough, your dentist may soon be urging you to trade in your 59¢ brush for the $20 model.

First on the market and first into the clinics, Squibb and General Electric have financed most of the test-

ing. The investigators have rated the cleaning ability of the electric brush by how well it removes plaque and food particles. Plaque is a soft coating on the teeth. It turns to tartar (the medical term is calculus) which can be removed only with dental instruments.

As good—but not better

For gums, the worth of the electric brush has been judged by rating its effectiveness in preventing inflamed (gingivitis) or diseased, receding gums (periodontitis) or restoring the gums to their normal mottled pinkness.

None of the testers have found the electric brush inferior to the hand brush.

Several, however, found the hand brush just as good. After coming to this conclusion on the basis of trials at the Temple U. School of Dentistry, Dr. Neal W. Chilton noted the previous, more optimistic reports. He decided, "Most of the findings are clinical impressions, rather than the results of carefully and well controlled quantitative studies such as the one reported here."

Equally careful investigators have detected a slight edge for the electric brush. Dr. W. G. Cross of the Eastman Dental Hospital in London estimated 25 percent greater effectiveness.

Among one group, the case for the electric brush is clearly proved. These are persons who can't maneuver a hand brush—the very young with their poor coordination, the very old with tremors or other disabilities and the physically or mentally handicapped of all ages.

Anticipating questions about tooth wear, G.E. researchers simulated 20 years of hand and power brushing on elephant tusks. Tusks duplicate dentine, the part of tooth under the enamel and sometimes exposed along the gum line. Enamel itself is too hard to wear.

People press twice as hard and take strokes five times as long when hand brushing, G.E. claimed, and set their lab machines accordingly. As a result, power brushing caused less wear. But whether hand or power brushing, the investigators discovered, "Every control test using distilled water without dentifrice showed very low abrasion, thus confirming the conclusions of others that wear was due primarily to the dentifrice."

Cautious dentists

On the whole, the data is mixed enough to keep the American Dental Association cautious. It said in a September announcement, "Preliminary results of clinical tests also suggest that these two electrically powered brushes (General Electric and Squibb) may be superior in cleaning ability to the ordinary toothbrush as used by the average individual.

"It is still too early to know the therapeutic value of these brushes; their ability to aid in the prevention of dental caries (cavities) and peri-

The electric toothbrush is a boon for the very young, the very old and the physically and mentally handicapped.

odontitis (gum disease) cannot be determined as yet."

In November, the House of Delegates of the ADA authorized the Council on Dental Therapeutics to study and report on electric brushes, product by product.

This gives G.E. and Squibb a tremendous jump. Both have a backlog of test data and the money to finance more. Two of their leading small competitors, makers of the Universal and the Electra-Dent "200" brushes, have modest testing plans or none at all. Larger companies such as Westinghouse, Sunbeam and Ronson, which have lately moved into the market, can afford a battle of test results.

Most electric brushes are very similar. It may not matter so much which of the better electric brushes you use, or even whether you buy any, as much as whether you brush regularly and well. Past surveys have found that most people don't. During clinical trials it is common for participants to improve their brushing habits—both those using hand brushes and those using the electric brush.

The simplicity and novelty of using the electric brush may encourage more faithful brushing. At least for a while. Dental students undergoing a one-brushing trial at the Tufts U. School of Dental Medicine brushed 0.3 to 0.9 minutes longer with the electric brush. Over a longer stretch, human nature may reassert itself. Of 61 patients given a free electric brush during a three to nine month test, 20 quit using it.

A team at the U. of Michigan purposely designed their tests to avoid what they called the "novelty effect." They concluded that "on the average, the electric and manual brushes are equally effective."

Still, the prices should strengthen your resolution to use your electric brush religiously. They range from $2.98 to $20 list, but few of the well-built models list under the top. In practice, discounts are the rule. A large New York department store sells $20 brushes for $14, $12 and $10.

The power problem

In consumer testing, a major failing of lower price brushes and even some of the more expensive products is inadequate or short-lived power.

The type that plugs in like an electric razor has no power problem, but it is a potential shock hazard if it is dropped in a basin of water. As long as its water-tight seals hold up, it's safe.

Battery drives are portable and safe but less dependable. The rechargeable type sits in a charger base between uses. To replace the batteries costs $5.95 for the GE. The price for a change of dry cells in the Universal is $1.

Three types of motion

There are also three choices of motion—up and down, side to side and rotary. Westinghouse is hedging with a combination up and down, side to side movement. Most late entries have one or the other, perhaps because rotary brushes tend to scratch the inside of the cheek. To prevent this, one model has a plastic guard, but it makes the brush so bulky it is difficult to reach the back teeth with it.

These mechanical details are secondary. The real issue is whether electric toothbrushes are better for you. A final verdict will have to await the ADA decision.

Meanwhile, with more money than caution, the public snatches up electric brushes, perhaps as gifts for the man who has everything except the desire to brush his own teeth.

★ ★ ★

Secrets of the frigid fish

Scientists have managed to keep a large Antarctic fish alive for 10 days. This was an important feat for a Stanford University research team at McMurdo Sound, in Antarctica. They are trying to find out how these fish thrive in water that is permanently at freezing temperature.

The biologists got the fish from the mouth of a seal which had caught it in ice-covered McMurdo Sound.

The fish has been tentatively identified as a *Dissostichus mawsoni*, which is found only in the Antarctic and has no common name. The first part of its formal name refers to its double row of upper teeth; the second part honors an early Antarctic explorer. Few specimens have ever been caught and none kept alive.

This *Dissostichus* was 51 inches long and weighed 47 pounds. It was dark gray, with wide light gray vertical strips that disappeared when it was irritated (a characteristic of some other fish). It had large bulging eyes.

The fish, unhurt except for a bite on the end of its tail, was grabbed by a group studying Weddell seal behavior and rushed to the fully equipped biology laboratory. Fish specialists made physiologic tests during its captivity and performed post-mortem examinations afterward.

Arthur J. De Vries, field leader of the Stanford project, explained "cold-adapted fish in the Antarctic have much higher metabolic rates than is to be expected at frigid temperatures, and seem to have more efficient mechanisms for converting energy into growth than do fishes in warmer waters. If we could understand these mechanisms, we might be able to increase production in warmer waters.

"Most of the fish we have experimented on are less than one foot long. Fish of much larger size will provide important additions to our data."

Does poison make us dream?

A NATURALLY created toxin from the central nervous system may stimulate dreams, says a scientist who has made a career of studying sleep.

Dr. William C. Dement, a neurophysiologist at Stanford University's School of Medicine, Palo Alto, Calif., has suggested that it is the body's efforts to clear the nervous system of that poison that initiates dreams.

Dr. Dement studied the results of his dream deprivation experiments, tests by other scientists on laboratory animals, and clinical studies of 17 persons who suffered from brain damage that prevented dreaming. His conclusion: that a biochemical mechanism, rather than a purely psychological one, may be involved in the initiation of dreams.

This was the first suggestion that a chemical might be responsible for dreams. Such a theory conflicts with some psychoanalytic theories that dreams stem from psychological needs of the dreamer to release various unconscious thoughts and emotions in his sleep. However, the theory does not conflict with current psychoanalytical uses of dreams as reflections of a person's unexpressed or inexpressible feelings.

Dr. Dement observed, "Whether or not an unaltered psychoanalytic theory of dreaming is compatable with all these findings is a problem for further investigators.

In Dr. Dement's dream deprivation experiments, volunteers were allowed to sleep, but not to dream. As soon as dreaming began—and investigators can recognize the onset of a dream by rapid motions of the sleeper's eyes, which can be detected even though the eyes are closed—the subject would be awakened. He then would be allowed to go back to sleep until he started to dream again.

Evidence of severe psychotic derangement appeared in the two volunteers after about two weeks of dream-deprivation.

In one case, a "rather taciturn

and quite inhibited person with high moral standards" expressed the desire to do things he would not ordinarily have considered doing, Dr. Dement said.

"Among these was the desire to enter a tavern and cheat the waitress out of drinks as well as a desire to go to a burlesque show."

When the subjects were allowed to dream again, they had more dreams than they would have had during a normal night. This tendency to try to "make up" for lost dreams was also noted during the experiments when the volunteers started to have more dreams than usual.

The schizophrenic child

In America today, tens of thousands of youngsters suffer from serious childhood mental illnesses.

A pamphlet issued by the Public Affairs Committee, Inc., *Serious Mental Illness in Children,* gives a frank picture of the problem of childhood schizophrenia.

Who are these children? The author, Harry Milt, quotes a director of a school for mentally ill children: ". . . the silent ones who stare vacantly into space; the gentle ones who hide their faces and turn from all human contact; the restless ones who wander, whirl or rock aimlessly; the agitated ones who scream out in savage fury; the explosive ones whose wild tantrums and panic are just a step away from chaos.

"There are those who . . . spend their lives in voiceless isolation. There are some who speak endlessly. . . . There are those who are always in motion, and others who retreat to corners, encircled by their own isolation. . . ."

Can this tragic disorder be treated? Can it be cured? The author finds that authorities estimate that between a third and a half of the victims ". . . can be helped to achieve . . . a substantial degree of normal functioning but only through long and sustained treatment. Another third can be relieved of the most severe and disturbing symptoms, but must remain in a protected environment. The rest cannot be helped at all, except to subdue the most disturbing symptoms such as agitation, hallucinations and delusions."

Milt stresses the importance of setting realistic goals: "To look for full restoration of a normal personality is unrealistic and can only lead to disappointment."

Beware tranquilizer addiction

Evidence is piling up that some of the most popular tranquilizing drugs can be addictive and dangerous.

Dr. Carl F. Essig of the Addiction Research Center of the Na-

tional Institute of Mental Health, asserts that tranquilizers could lead to automobile accidents, the inadvertent starting of fires, and violent behavior. In some cases, when the drug has been abruptly withdrawn, the patient has died.

Among those products that must be considered "drugs of addiction" Dr. Essig lists: meprobamate (Miltown and Equanil), glutethimid (Doriden), ethinamate (Valmid), ethchlorvynol (Placidyl), methyprylon (Noludar) and chlordiazepoxide (Librium).

Dr. Essig notes that one of the characteristics of addictive drugs is that the persons who take them may keep trying to increase the doses. This, he says, is particularly true of persons with character disorders or psychoneurosis, and in some cases persons who are alcoholics.

In a study designed to test the effects of tranquilizers on driving it was found that over a 90-day period, the automobile accident rate among 68 users of Librium was 10 times higher than normal.

A "significant impairment" of performance was observed in simulated driving tests given to eight subjects who received two different types of tranquilizers.

College students who received one-tenth of a gram of Pentobarbital showed impaired performance in a series of tests in arithmetic, visual perception and other tasks, according to Dr. Essig.

Sudden withdrawal of the drugs from a person addicted to them can cause convulsions or other manifestations like those of delirium tremens in an alcoholic. In some cases, death has resulted from sudden withdrawal.

While noting the usefulness of tranquilizers, Dr. Essig urges that physicians remember the dangers of the drugs' abuse "and exercise caution in prescribing them."

All of us

How many people are affected by some sort of emotional illness? "One out of one of us," says the head of the famed Menninger Clinic in Topeka, Kansas.

Dr. William Menninger says that most people think of emotional illnesses only in vague generalizations like "nervous breakdown" or "shell shock."

Talking typewriter teacher

A typewriter that talks is being used to teach very young children all sorts of things.

Dr. Omar K. Moore, recently appointed professor of psychology at Rutgers University in New Jersey, believes that a child in an "optimal" learning situation can learn skills at an early age in much the same manner as he learns to talk.

For the last five years, Dr. Moore has been teaching children between the ages of two and five to read, write, typewrite and take dictation. Now he is hoping to extend his teaching experiment to include foreign languages and mathematics.

To provide the right sort of learning environment, Dr. Moore and engineers from the Thomas A. Edison Research Laboratory developed a booth housing an electric typewriter, projection and recording instruments and other equipment.

When a child strikes a key on the typewriter, a recording tells him the name of the letter he hit. An instructor watches the child through a one-way window and takes him out of the booth if he gets tired before his half-hour session ends. The instructor also moves the child on to more advanced stages of learning as each step is mastered.

At one point, a projector shows letters and words. At the same time, all the keys of the typewriter are locked except those matching what the child sees, and he searches until he finds the correct one.

At other stages, the child writes letters on a blackboard or else he types sentences that are dictated to him.

In all the activities, the child works alone. The instructor only presents material and records behavior and progress, but never helps the child, who must do everything for himself.

Does the system work? Dr. Moore says his experiments have shown that children have markedly increased their I. Q. scores.

Psychic-drug controversy—a quiet interlude

Two of the most controversial scientists of recent years are living quietly in an upstate New York town. Far from the publicity and outright hostility that surrounded them, they are consolidating the results of their research in the seclusion of a 53-room mansion in Millbrook, N. Y.

Psychologists Timothy Leary and Richard Alpert, whose work with hallucinogenic drugs such as LSD-25 cost them their positions at Harvard, made hardly a splash when they moved into the town of 1,700, according to *The New York Times*.

The psychologists say they are not presently doing active research with the drugs, which they call "consciousness-expanding drugs." They are no longer able to get them legally, as they did when they were members of the Harvard faculty or for a time in Mexico.

LSD, the most potent of these drugs, is generally available to psychiatrists as an experimental therapeutic agent, but it is not very widely used.

Inside the Bronx Zoo

Photos and text by Bruce H. Frisch

Animals at America's largest zoo live longer and healthier lives than their brothers in the wild because of men like these.

Veterinarian—
Dr. Charles P. Gandal: He puts the lion on a diet, pulls a python's tooth.

Keeper—
Dick Bergman: He watches his monkeys with a fond—and wary eye.

Curator—
Joseph Bell: When a bird has trouble getting out of the shell, he's there to help.

Doctor

"TURN him over," said the man in the white coat.

His two helpers slowly eased a young Nyala antelope onto its right side and lowered it gently back to the examining table. He finished binding a metal splint to the antelope's right front leg. The antelope submitted meekly. An hour before, Dr. Charles P. Gandal had begun his working day by injecting it with tranquilizer.

"He's got a small fractured bone near the end of his leg. I set it Monday, but it got twisted, and I had to reset it today," the doctor said, wrapping the leg.

Two researchers from Columbia-Presbyterian Medical Center had come to the zoo for ape blood to use in chromosome studies.

A keeper, wearing leather gloves, brought in a grey gibbon ape. "These things can really bite," he said.

"Do you think you can hit the vein first try?" a researcher asked Dr. Gandal.

"Bet a beer I can," he answered, and did.

"Phew. Now for some lunch. At two I'll make some rounds."

At 2 p.m. Dr. Gandal pulled up to the African Plains in his midget animal ambulance. The lion keeper had reported that Charlie, the male African lion (left) had a growth, a big ball, under his stomach. The lion was stretched out on the ground, so the keeper went around the side, behind a fence and made a noise. The lion started, and loped across the grass.

He's fat. They're both fat," Dr. Gandal snapped. "Cut back on their feed three pounds a day." Normally, Charlie and his mate, Princess, share 16 pounds of horsemeat a day.

"An animal that's fat is not a healthy animal. They're not in good reproductive condition," the doctor said.

A note about the python was waiting for him when Dr. Gandal returned to the hospital late in the afternoon. He called the Reptile House: "I've got a call about a man-eating snake . . . . Yeah, I'd love to brush his teeth. I'll be right over."

At the Reptile House, Dr. Gandal took out his instruments as the python's keeper entered the glass-fronted cage. The 19-foot-long snake (below) hardly stirred until the keeper gripped it behind its head. The other keepers strained to hold several more feet of snake behind. When the python opened its mouth, a fourth keeper pushed a length of rubber hose between its jaws. The doctor swabbed the lower jaw.

"It's had infected teeth. One was loose. I took it out with the tweezers. A new one will grow in."

Keeper

"THESE Old World monkeys, you can feed them garbage and they do great," said Dick Bergman, senior keeper at the Monkey House. "South American and Central American monkeys are more particular, and those are the kinds you see in pet shops.

"We get people here all the time saying, 'I've got a beautiful pet monkey. Do you want him? He doesn't bite.' And there's their thumb all bandaged.

"People come in here and want to know what kind of monkey they should get. I try to talk them out of it. Just house-breaking them. The monkey climbs up the curtain and makes a mess on it. After awhile they begin to smell. People don't feed them right, and they go right downhill."

"Most monkeys are very good mothers. Once in awhile you get one that won't take care of its young. Usually their first born. They're so excited they don't know what to do with it. This wanderoo has had six" (above).

"With monkeys you have to be alert. They'll jump out of the cage or jump on you. I was working with two grey monkeys once, and first thing I know they were both on my back scratching and biting. I couldn't reach them so I had to back against the wall.

"Rhesuses and macaques won't bother you, if you don't look at them. You can sweep or clean up as long as you keep your head down."

Curator

JOSEPH BELL, the assistant curator of birds, finished weighing a brown paper bag that seemed alive. He caught it just as it was about to slither off the weighing pan of the balance. He cautiously reached inside the bag and pulled out a bird.

"I'm getting this green broadbill (above) ready to put on exhibition. These tail feathers are just stubs. I'm pulling them out to make him moult and grow new ones. He'll be in the same room with the hummingbirds. Hummingbirds are so delicate we don't handle them unless we have to. One night a big shipment of hummingbirds came into the airport. There were eight or nine. I looked in the cage, and six were in trouble, lying on the bottom of the cage. They looked dead. They were, almost.

"You pick one up and put its bill between your lips. Pretty soon they taste the sweetness of your saliva. Next thing you feel its tongue darting into your mouth. Quick, you shove its bill into a bottle of sugar water. The workers around, the guys who shove freight, saw me and probably thought I was nuts. When they saw the hummingbirds come around, they thought it was a miracle. As each bird revived I'd give it to a man. 'Here, keep doing this,' I told them, pushing its bill in and out of the bottle. I had them all standing around, each with a bird."

Bell picked up a dull brick-red egg from the incubator (above).

"This is the egg of a crane (right). You can't candle these. They're too dense. When you think one's ready to hatch, you put it to your ear and listen for scratching.

"We get most of our birds from dealers. They don't supply only zoos. There are private collectors too, and the same outfits supply monkeys for research. Then there are the birds sold in five-and-tens. It's a shame the way they bring them in. I've seen at least 10,000 mannikins and wax-bills at the airport. They dye them lavender, every color under the sun.

"People call us up and want to sell us their bird. 'It's beautiful, a beautiful blue,' they'll say.

"'It's probably dyed,' I tell them.

"'Oh, no, I bought it that way.'

"Wait until it moults and see if it's not dyed."

Photos by Alan D. Haas

If nuclear war threatened to wipe out Washington, President Johnson and his staff would helicopter to a top secret "Floating White House"—the *U.S.S. Northampton.*

The Navy's most "hush hush" ship

In port, a marine stands guard at the Northampton's gangplank 24 hours a day.

President Kennedy boarded and inspected the Northampton when it took part in fleet maneuvers in 1962.

THE whereabouts of the *U.S.S. Northampton* are never divulged more than 24 hours in advance, and sometimes not even that is permitted. But this much is known: The ship, based at Norfolk, Va., is either in her berth or in the North Atlantic, within helicopter range of the White House.

Loaded with virtually every type of modern electronic communica-

tions device, the ship has been designated for use by President Johnson and his staff in event of a national emergency such as a nuclear war that threatened to wipe out Washington, D.C., or make it uninhabitable.

The ship's superstructure is a jungle of antennae. Her 60 transmitters and 150 receivers can handle as many as 3,000 radio messages a day. All in all, she has some 40 tons of communications sets.

Just exactly what sort of equipment she carries is a closely held secret shared only by the Joint Chiefs of Staff and top personnel in the Department of Defense. The ship is so secret that one segment, known as "Operations Control Center," is kept locked at all times. Even the commanding officer of the *Northampton* is forbidden to enter that part of the ship, except by special permission from top brass in Washington, and then only under armed guard.

The *Northampton* is designed to withstand, as far as possible, any atomic, bacteriological and chemical weapons known. She can be rigged "as a closed envelope" in battle conditions. And she has a salt-water washdown system to flush away fallout contamination. Her smooth contours and steel decks, except her wood-covered flight deck, greatly improve the efficiency of the washdown system.

The *Northampton* has facilities for four helicopters. These could be used to ferry the President and his staff to the ship in a hurry.

President Johnson would [illegible] strategic operations from this chair [illegible] (below) aboard the Northampton.

The ship can carry four helicopters which could bring the President and his staff aboard in a matter of minutes.

Now designated a CC-1, or command ship, the Northampton has virtually every piece of the latest electronic gear.

A battery of teletypewriters are part of the Northampton's vital equipment in top secret Combat Information Center.

The cruiser's most striking feature is her forward tower, upon which is mounted one of the largest seaborne radars in the world. The antenna, stabilized to offset roll and pitch, has a diamond-shaped parabolic reflector screen. The antenna and stable base assembly extend 38 feet above the top of the tower and have a mass of 26 tons.

Component parts for this huge set fill four below-deck radar rooms. Just exactly what it can do is known only to a select few in the nation's capital.

It was disclosed in 1962, incidentally, that the *Northampton* set a

record in naval communications when a message was sent around the world by radio in 0.8 of a second.

The keel of the present *Northampton* was laid down in August, 1944. She was designed as a heavy cruiser. Later, she was redesigned as a Command ship, CC-1 in Navy parlance. Millions of dollars were spent to convert the ship.

Her main gun battery was eliminated to provide additional staff, command and communications facilities. However, she is still heavily fire powered.

She displaces 17,200 tons, measures 677 feet in length, has a beam of 70 feet, and draws 25 feet of water.

Sometime this year, the Navy expects to complete outfitting a second command ship, the *U.S.S. Wright,* a light aircraft carrier. The conversion job will cost an estimated $25 million. According to Defense Secretary Robert McNamara, the *Wright* will also be kept in the Atlantic on a standby basis, in case of war.

In the meantime, the *Northampton* stands ready as the emergency capital of the United States. It is a ship everyone hopes will never have to be used.

The radar plot in the Communications Information Center is part of a system that is one of the most massive and complex electronic systems ever installed in a naval vessel.

HAVE you been in voice communication with space recently? It's possible that you have and didn't know it.

How?

Well, not long ago, in a test, the American Telephone and Telegraph Company began sending ordinary transatlantic phone calls by way of communications satellites orbiting thousands of miles above the earth. The people at each end heard each other as well as if they'd been a couple of miles apart. The telephone company checked the callers on their reception after each call, but didn't tell them they'd talked by way of space, so as not to influence their reactions.

The experiment dramatizes the

Communications satellites are paying the first direct return on investment in space. Maybe even you have used them.

A space project that makes

by Eugene R. Eisman

Relay

Echo II

first space project to make clear economic sense in this dazzling but often far-out Space Age. The project has a long way to go, but it has also come a long way since its beginning on August 12, 1960.

In the early morning hours of that summer day, a Delta launch vehicle of the National Aeronautics and Space Administration lifted from Cape Canaveral, carrying the Echo I balloon satellite.

Within minutes, the tiny payload was in orbit and sprang into action. Gas from a vaporized chemical compound inflated a 100-foot sphere of paper-thin aluminum and plastic. Echo I was a satellite with a practical mission.

Before then, earth satellites had been little more than packages of instruments taken from their earth environment and placed into orbit with the hope that they would be able to tell man a little about the unknown sea surrounding the earth.

Echo I was an effort to use a spacecraft to solve a complex problem—what to do about overburdened long-distance communications facilities.

this nation's multi-million-dollar

More calls overseas

For a long time, the number of overseas telephone calls placed in the United States had been growing at a tremendous rate. In 1960, three million such calls were made.

The Atlantic cables are able to handle less than 400 calls simultaneously, though the demand for circuits is much greater than that. It was also apparent in 1960, as it is today, that something would have to be done about the high cost of transatlantic calls. While the price of three minutes to Europe has come down to $12 (from $75 in 1927), it will have to be lowered much more to open up a mass market.

The answer to the communica-

The communications satellite has brought about the entry of private enterprise into the Space Age.

tions problem was not to be found in more cables or high-frequency radio facilities. The cost of laying cables is extremely high—the most recent one cost the United States and England $47 million. And the system of micro-wave relay towers used to send television and telephone signals over large land masses is obviously not feasible over the great water bodies.

The only solution seemed to be a system that could operate independently of both earth-based relay equipment and cables. It would also have to be free from the interference often caused in overseas communications by sun storms and disruptions in the ionosphere.

A satellite orbiting hundreds of miles over the earth with a built-in micro-wave repeater met these requirements.

During its four-and-one-half months of useful life, Echo I was successful in demonstrating the feasibility of such a plan. It bounced signals—without amplifying them, since it contained no micro-wave repeater—off its highly reflective skin from the Bell Telephone Laboratories in Holmdel, N. J., to the Jet Propulsion Laboratory's Goldstone Station in California.

Perhaps the most spectacular development in the use of earth satellites for global communications is the exchange of live television between the United States and Europe. First demonstrated on July 23, 1962, when programs from Europe were seen live by Americans for 20 minutes, transatlantic television has become a common occurrence.

Previously, the fastest way to get film or video tape from Europe had been to send it by jet plane, an 8-hour trip. Another method perfected by the National Broadcasting Corporation was a time-consuming process in which individual pictures were broken down into radio impulses and sent through the Atlantic cable to be re-assembled on the other side. The picture quality of this method was usually poor.

Private enterprise in space

The communications satellite has brought about the entry of private enterprise into the Space Age. The American Telephone and Telegraph Corporation announced in April, 1961 its plans to orbit an experimental communications satellite. In July of that year, the first of two Telstar communications satellites was fired from Cape Canaveral.

AT&T designed and built the Telstar, and it is the world's first privately owned spacecraft. It paid

NASA $3 million for each launch, and probably got its money's worth from the publicity alone.

However, Telstar, Relay (another TV satellite, with two versions now in orbit) and Echo are little more than experimental vehicles; just small way stations on the path to full realization of the usefulness of communications satellites.

Satellite Corp. formed

In an effort to properly control and use the future developments in this field, Congress in August, 1962, passed the Communications Satellite Act, establishing the Communications Satellite Corporation. This private corporation was charged with the future development and operation of communications satellite systems. NASA provides the corporation with launching and other necessary facilities.

This set-up is unique, and passage of the bill was secured only after a long and bitter Congressional fight in which opponents charged it was a "giveaway of hundreds of millions of dollars in technology developed at the taxpayers expense."

Supporters of the bill held that a private corporation would "have greater flexibility, greater speed and more risk taking" than the government "and that this would lead to more expedient development of a commercial communications satellite system."

Including fiscal year 1964, NASA has spent about $127 million on research and development of communications satellites. While a "dividend" on this sum has been paid by the telephone, telegraph and television experiments successfully completed, there is still much to be done before there is any large scale return on this investment.

NASA has been experimenting with two types of systems—passive and active. The passive satellite is represented by Echo. It does not carry its own power supply, and only reflects messages from one point to another. NASA's Telstar, Relay and a revolutionary type called Syncom are active spacecraft. They carry a power supply and receive, amplify and re-transmit space communications. It is thought that future operational systems will be of the active type.

A larger Echo satellite

However, NASA recently prepared to orbit Echo II, a larger version of the first Echo. This promised another "dividend" in the form of the first United States-Russian joint work in communications satellites. Both nations were to bounce messages off Echo II.

It may be possible to provide 24-hour-a-day communication between any two points on earth with a network of only three satellites. Three Advanced Syncoms would be placed in stationary orbit above the equator at an altitude of 22,300 miles. They could provide television, teletype and telephone circuits.

The practicality of such a system was demonstrated by Syncom II,

orbited in July, 1963. However, it will be several years before any type of operational system using Advanced Syncom can be established.

Another lesson learned from the communications satellite program benefits the entire United States space effort. That is the advantage of installing redundant circuits in spacecraft. Such a circuit provides a back-up in case the original circuitry fails, and was used to keep Relay I working after a component failure.

Leonard Jaffe, NASA's director of Communications Programs, says this factor is responsible for "a significant increase" in the useful life of its spacecraft since the first launchings in 1958.

NASA feels that any operational communications satellite systems will have to have a useful lifetime of two to 10 years in order to be economically feasible.

Nuclear power is being investigated and advanced types of batteries are being designed. Jaffe says some consideration is being given to eliminating storage batteries completely if a more usuable unit is not developed soon. This would mean more dependence on solar power, and several new types of solar cells being test flown on communications satellites.

The communications satellite will be paying a good many more dividends in the years to come and may prove to be our most profitable investment in space.

From "A History of Domesticated Animals."

Ancient Egyptian drawing whimsically shows upright foxes leading goats.

Curb your pig

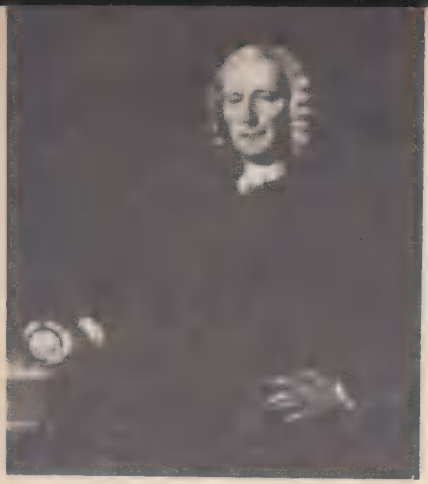
For centuries, hunting wild game in certain parts of the British Isles was forbidden to commoners. To discourage poaching, the lowly were allowed to keep only dogs considered too small for hunting. But poachers are remarkably versatile. Enterprising Englishmen trained a most unlikely animal for hunting—the pig. Because of their excellent noses, these hunting pigs were reputed to be even better than pointers in locating partridge, pheasant, snipe and rabbits.

Pigs have had other odd uses. In ancient Egypt and Greece, muzzled pigs were walked over newly seeded ground. Their pointed feet planted the seeds at just the proper depth. Even today, pigs with efficient noses are used to grub up truffles, highly prized subterranean fungi. Mostly, however, pigs have been eaten.

In his massive volume, *A History of Domesticated Animals* (Harper & Row, New York City, 560 pp., $12.00), Professor F. E. Zeuner presents a wealth of facts that are sure to interest any animal lover. For the more specialized reader, the animal breeder or the biologist, the book provides a complete and concise background on every domestic animal from the elephant to the silkworm.

The historian and archaeologist, too, should find plenty to interest them, for man and his animal helpers moved toward civilization together. Were it not for domestic animals, we would still be chasing wild boars with our bows and arrows.

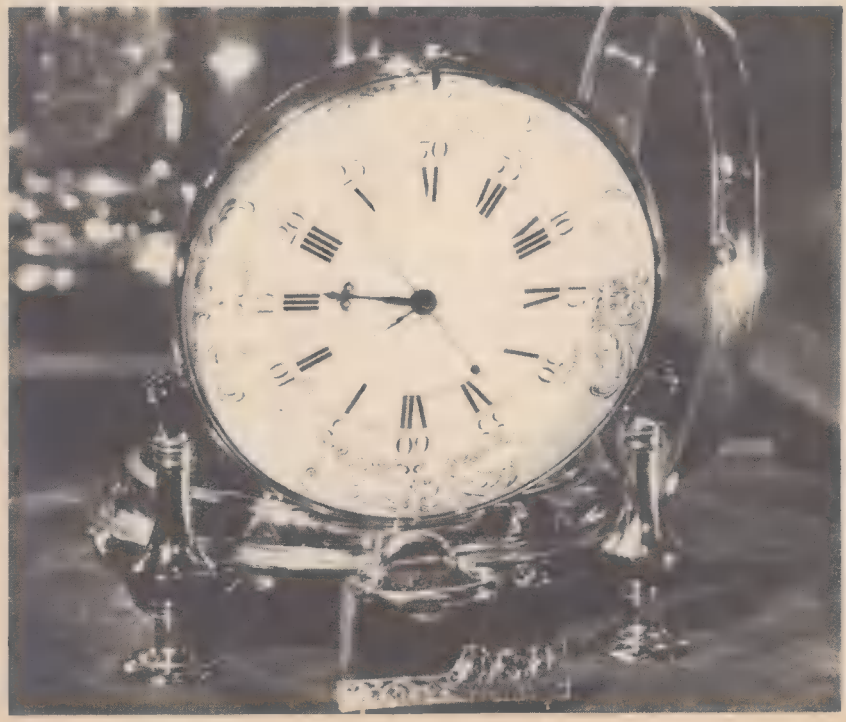
How did domestication begin? Zeuner speculates that in the case of dogs, perhaps man's oldest companions, "the cunning of the dog and his concerted efforts on hunting expeditions are not unlike the hunting practices of early man. It is, therefore, not impossible that young wolves or jackals or other wild dogs, which grew up in, or near, the temporary camps of Mesolithic hunters, would quite naturally regard these men, who provided part of their food supply, as members of their pack, an association which the hunters would not have failed to turn to their advantage."—*D.C.*



He was an unlettered English carpenter, but he built the best clock that ever was. And countless sailors owe their lives to it.

John Harrison's million-dollar clock

by Harold Helfer



It is 200 years old now but some say it is the most wonderful timepiece ever built.

They aren't referring merely to the intricacies and handsomeness of design, elegant though it unquestionably is, but to its performance and purpose.

It would be safe to say that no timepiece has ever had such a profound influence on history as this one.

Now on display at the U. S. Naval Observatory in Washington, D.C., this clock has become known by the rather drab nomenclature of "Harrison No. 4." You'd never be able to tell from this that it practically revolutionized sailing.

Where are we?

Ships simply don't get lost any more. Time was when they were always losing their way. In mid-ocean, away from any shore lines, the sea looks pretty much the same wherever you are. You can't tell where you are just from looking around.

Britain, as the leading seapower of the world, was keenly aware of this problem and in 1714 the British Government offered 20,000 pounds to anyone who could come up with a "generally practicable and useful" method for ships being able to locate themselves at sea. Twenty thousand pounds is perhaps the greatest prize ever offered by a government—it would be worth more than a million dollars today.

Naturally, a lot of people were attracted by this offer. One was John Harrison, an unlettered carpenter from England's North Country. His idea was simply to create a clock, but a darn good one, the best there ever was.

The ocean is divided by imaginary lines known as longitudes. If you could ascertain where you were in relation to a longitude, then you'd know where you were and how to proceed. Theoretically, it was simple enough to keep up with the longitudes . . . all you had to do was time yourself correctly when you set out on an ocean trip, since longitudes were evenly spaced and designed with the time element in mind.

The trouble was that timepieces were not as accurate as they should be and that even the most accurate one went awry at sea, having to contend as it did with the motion of the ship, sudden variations in heat and cold, abrupt changes in humidity and the differences encountered in the pull of gravity.

A perfect machine

So what John Harrison attempted to do was create a clock that was so perfect mechanically that it could even take the difficulties of a sea voyage in stride. It was no easy task. Sometimes it seemed all but hopeless to try to create something that had to be almost perfection itself. Nevertheless, the British carpenter persevered, not only for weeks but through weary painstaking months and years as well. Final-

Even from the back Harrison's clock (left) is not only a mechanical masterpiece but a masterpiece of decoration as well.

ly, in 1759, 45 years after Parliament had announced its great prize, John Harrison had created his master clock.

At its present home in Washington, where it will be on loan from the British Government for many months, the carpenter's clock still keeps ticking merrily away and is accurate, more than 200 years after its creation, to 10 seconds a month.

John Harrison, though he himself never used such a fancy word, had come through with the world's first chronometer, as marine timekeepers are now called. There is no telling how many ships and lives this instrument has saved.

This granddaddy of the chronometers is called "Harrison No. 4" because the English carpenter turned out three other timepieces before coming through with the masterpiece that was to win for himself a great fortune and for the world a priceless heritage.

★ ★ ★ ★

People who walk through glass

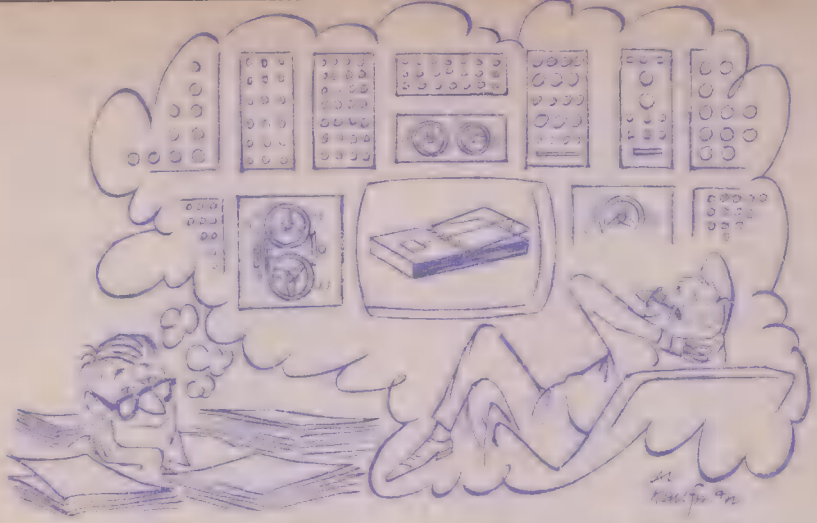
TRIED to walk through glass recently? With all the glass in modern buildings, it's not surprising that a lot of people do try.

The American Medical Association estimates that 40,000 Americans a year are hurt, trying to walk through glass doors, glass walls, picture windows. Actually many more try, but 40,000 is the number that are injured so severely that they show up in accident records. Almost 6,000 wind up in the hospital and some even die from severe cuts and loss of blood.

The problem of glass-door accidents has become so widespread that many localities have adopted building codes requiring that safety glass be used. Safety glass will raise a bump, but it won't shatter and cut.

Studies have shown that over two-thirds of the glass-door injuries are suffered by males, and that children 5 to 14 years of age account for one third of all injuries. More than three-fourths of the injuries occur in the home, and about three-fourths occur when the victim is passing from the inside of the house to the outside. Hurrying is the major cause, much more so than slipping, crowding or horseplay.

The AMA recommends that if you don't already have safety-glass doors, you plan to change your ordinary glass to safety glass in your next remodeling project. Until then, everyone in the household should be made thoroughly aware of the dangers of severe injury from shattered glass.



Crisis in the Patent Office

by Stacy V. Jones

The Patent Office is falling further behind in its work every day. The whole system is in danger of breaking down before the flood of new inventions. Harried patent examiners dream of a machine that will end all their problems. But they know the solution will not be that simple. What's wrong and what can be done about it?

AMERICANS regard the patent system, like the stock market, as affording one of their traditional rights to make a killing. The Constitution authorized the patent system as one means "to promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."

The Patent Office was established in 1790 primarily as the guardian of the individual inventor, who often made and sold his product. Since the research laboratory became the incubator of invention, the protection has extended to the corporation, which owns the patents obtained for it by employees. Nowadays everybody who owns a share of stock or works for industry has an interest in the patent system.

It is natural, therefore, for all Americans to be concerned when a Senate committee reports that the Patent Office is confronted with a serious crisis in its operations, one

that will endanger the system's very existence if not solved.

Perhaps the committee views the Patent Office with undue alarm, but the office is certainly threatened by today's flood of scientific and technical information.

New or invalid

The problem is particularly acute in the Patent Office because it is charged by law with knowing, before it grants a patent good for 17 years, that the invention is new—that it has not already been patented, published or used anywhere in the world. If the examiners overlook something in this "prior art," a patent is likely to be invalidated when somebody questions it in court.

The examination procedure was established in 1836, when a freshman senator from Maine, John Ruggles, denounced the loose existing practice. He himself was awarded Patent No. 1, for a Locomotive Steam Engine for Rail and Other Roads. To "prevent the evil of the sliding of the wheels," he fitted them with cogs.

Senator Ruggles enjoyed the presumption that his patent was valid. He, like all the patentees who followed, could proceed with some confidence that his claim to be the first inventor was well founded. (In a country where there is no examination, an applicant gets only a priority date by filing, and must rely on the courts in disputes involving other points.)

But the Patent Office today faces infinitely more difficulty in giving such assurance than it did in 1836. That year, only 599 patents were granted. In calendar 1963, the total was more than 45,000, and that was 10,000 below the record year 1962.

It now takes an average of three and a half years to get a patent, and at year's end, there were 200,000 pending applications. Why, someone may ask, does it take so long? Can't they just hire more people?

Here invention is the victim of its own progress. The prior art already includes more than 3,000,000 American and 7,000,000 foreign patents, plus countless technical publications.

The volume and complexity

And the flood is growing, not only in volume but in complexity. Today we are inventing not merely mousetraps but computers, atomic power plants, lasers, rockets and space stations. The burden increases geometrically.

First, the attorneys must dig into the mountain of U.S. patents to find out whether filing a new application is worth while. This preliminary search cannot be done efficiently anywhere but in Washington.

Once an application has been

Stacy V. Jones writes Science Digest's "Inventor of the Month" and has written a weekly column for *The New York Times* since 1952. He is the author of *You Ought to Patent That* (Dial Press, 1962).

What about mechanizing the search to save all that shuffling through haystacks of papers looking for needles?

filed, and the examiner reaches it in the waiting pile, he must satisfy himself independently that nothing has gone before that will bar it. There follows what is called "prosecution"—exchanges of memoranda and written discussions of amendments to the patent claims, sometimes supplemented with interviews.

In this electronic age, the Patent Office, depository of technology, has not yet found the electronic tools that will relieve the patent examiners of the routine work, the interminable shuffling through papers. True, some progress has been made in the retrieval of information from punch cards, and a little time has been saved with microfilm readers, but the effect is miniscule.

The answer is not as simple as calling Civil Service for more examiners. Perhaps 400 or 500 would have to be added to the present 1,100 to handle the 1,500 new applications every week and eliminate the backlog. The Patent Office appropriation for the fiscal year ended June 30, 1963, was $27.5 million, and the House has approved $29 million for the present fiscal year. Even if Congress voted the additional funds, the qualified people would not be available. And there would be no place for them; each examiner now has space about the size of a billiard table top. A new building is still in the discussion stage.

Well, what about mechanizing search? It would seem simple, now that the computer is a common business tool, to store the technology in electronic memories and get it out by pressing a button. This should save man all that shuffling through haystacks of papers and microfilms looking for the needles.

But the job of shifting the routine work onto mechanical shoulders is easier for the layman to propose than for the scientist to accomplish. Specialists in government and industry have been working on it for 10 years, and they don't see light yet.

The first problem is to transfer the information from documents to

machine minds. In the present state of science, humans will have to decide what is to be stored. The quantities are vast. A patent, for instance, starts with a long disclosure, or set of specifications, in the inventor's words as formalized by his attorney. It ends with "claims of novelty."

A major question is linguistics, involving language that machines will understand. They must be instructed in unambiguous words. Researchers discovered early that if two things were involved, the machines were likely to reverse the order, putting the cart before the horse and the cheese outside the sandwich. One engineer found that prepositions have a mass of multiple meanings. Is the cart *behind* the horse in place, in time, in progress, or as a cause? He logged 13 meanings for *through*, 32 for *of*, and 43 for *to*.

Besides plain statements, there are implications that may be clear only to the technicians, the persons that the courts call "those skilled in the art." How are these implications to be preserved?

And suppose the specialists succeed in getting words into the machine memory, what about the drawings? Most patents include sketches of machinery, diagrams of electric circuits, or charts of molecules. Pattern recognition is much harder than understanding words.

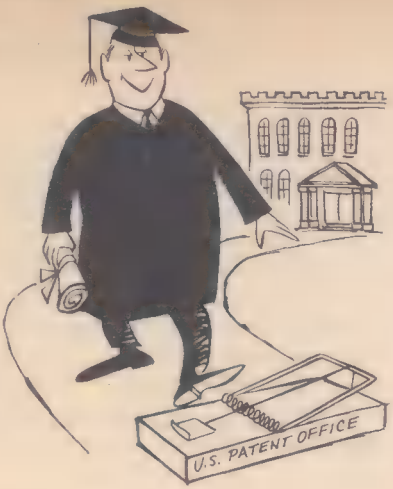
The government engineers have made some progress—to the extent of finding out how big their main task is. Appropriately, a joint computer research project by the Patent Office and the National Bureau of Standards is called Operation Haystack. The Federal specialists, and their opposite numbers in industry, have solved narrow problems. The Patent Office, for instance, publishes "decks" of punch cards for certain classes of steroid and organic phosphorus compounds. A searcher can run them through a punch-card sorter. Special industries make internal use of similar systems to good effect.

But these represent only small files of documents, and small successes. The overall need of the Patent Office, for a survey of all recorded knowledge in a given field, remains.

There has been no breakthrough yet to the goal of mechanized search. An educated guess is that it may not come for 20 years.

International cooperation

Mechanical and other patent problems are under international study. Representatives of the British, German, Swedish, Dutch and Japanese patent offices are attached to the Research and Development staff of the U.S. Patent Office, and exchange ideas with their hosts. In Vienna last September (1963), ICIREPAT (the Committee for International Cooperation in Information Retrieval Among Examining Patent Offices) considered common problems at its third annual meeting. Standing committees are beginning work on abstracting and indexing methods; equipment; termi-



Patent examiners must have engineering degrees, and it takes time to train them. Many of them leave to join law firms or big corporations.

nology, standardization and classification systems; and translation.

Even achievement of mechanized search would be only half the battle. The examiner now spends the other half of his time on intellectual work that the machine cannot take over. If all the patent numbers and other references are supplied him automatically, he will still face a growing job. There is the steady increase in the total number of patents outstanding, and therefore to be searched; the increase in the number of applications; and their growing intricacy. Applications involving long-chain polymers take longer to examine than those for pump handles.

For the present, Patent Office officials must continue to recruit examiners with the required engineering degrees, and try to hold them. Their training takes time, and when they have gained experience many of them are attracted to law firms or the patent departments of corporations. The turnover in these jobs runs as high as 20% a year.

The future depends on volume of applications in which the long-term trend is upward. If the Patent Office machinery does become clogged with paper, must the agency go out of business? There are modified patent systems that would relieve the examining staff. One is the plan the Netherlands Government has adopted, which was effective January 1, 1964, to replace its previous rigorous examination system.

In essence, the Dutch system, if it works, will lighten the office burden by avoiding the examination of patents that prove to have little interest. An application will be published, and can be kept alive for seven years by payment of fees, starting after the first two years. During the seven-year period, the applicant or an interested party may call it up for preliminary novelty examination, and later for final examination. If seven years go by without the second call, the application will lapse.

The Dutch expect the new system to result in abandonment of a large proportion of the applications. Under their previous system, which required annual fees, many were abandoned in the early years.

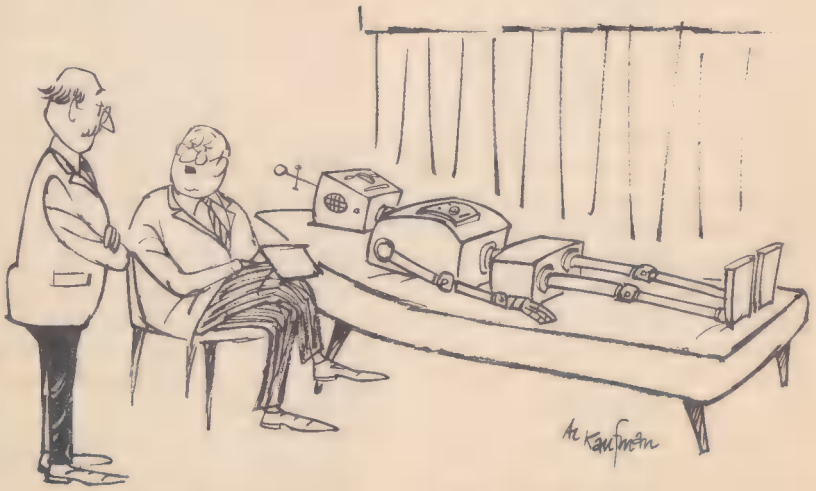
Committees planning a Common Market patent, to be valid for all six countries, have followed the Dutch proposal somewhat. If the program is adopted, the application will be subject to a formal examination leading to the granting or refusal of a provisional patent. The provisional patent must be given a full examination within five years, or it lapses retroactively.

Besides borrowing from the Netherlands or the Common Market, the United States could take a leaf from the British or German regulations. In Great Britain, only British patents are searched and only for 50 years. In Germany, foreign patents and technical literature are included, but back for only 100 years. Here we have no lower limit.

One American official hazarded that the Patent Office could go on with the present law and present methods for another decade without any desperate results. By then, if there is no breakthrough to mechanized search, we may have to reduce the examiners' burden in some other way.

The change will not come suddenly, for it will need legislation, and that means long committee hearings in both Houses.

If, eventually, inventors are offered provisional patents, they will still have one assurance: the presumption of validity that they have enjoyed for more than a century and a quarter.



"As I see it, Professor, he's got a screw loose."

the progress of MEDICINE

by Arthur J. Snider

Now—knifeless brain surgery

THE 54-year-old woman suffered from Parkinson's Disease, marked by tremors of the right arm, right leg and left hand.

She was cured by surgery that was knifeless, bloodless and painless.

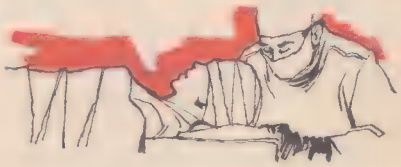
A beam of radiation from an atom smasher was trained on a portion of the brain controlling the abnormal movement. The stream of protons, traveling at the speed of light, raced through the bony cranium and penetrated the soft tissues of the brain without damaging them. The beam expended the bulk of its energy on a deep cluster of brain cells the surgeon wished to destroy. The patient left the hospital the next day.

The atomic operation was carried out by Dr. Lars Leksell, professor of neurosurgery, in Stockholm, Sweden. It has been perfected after 10 years of experimentation. During 1964, it will be used on many of the hundreds of Parkinson's patients awaiting treatment in Sweden.

The disease is effectively treated in the United States by use of a freezing tool, a technique worked out by Dr. Irving Cooper of St. Barnabas Hospital, New York.

While the Cooper surgery also is bloodless, it requires an opening into the skull to permit entry of the freezing probe.

Dr. Leksell is hopeful that equally good results will be obtained with radiation.



"We have gone slow because we did not know whether there would be any long-term adverse effects from radiation," he explains.

"But now we are convinced on the basis of animal and human studies that there is no untoward hazard."

Under construction in Stockholm is a special heavy radiation particle emitter, the first medical cyclotron especially designed for brain surgery.

In Berkeley, Calif., the powerful beams of heavy nuclear particles from a large cyclotron have been used successfully to treat Cushing's Disease, a frequently fatal ailment.

Medical approaches to treatment have not been successful. Surgical approaches have consisted of removing the adrenal and the pituitary or master glands, but these involve considerable risk. Radiation in the form of X-rays or radioisotopes has been employed with partial success. The chief limitation is the small dosage required to avoid destruction of healthy surrounding tissue.

Dr. John A. Linfoot, reporting in the *New England Journal of Medicine*, says the beam of high energy particles produced by the cyclotron can be directed at the small target area within the pituitary with twice the effect per unit dose as when using X-rays.

In the first three cases, all symptoms of the disease disappeared.

The disease doctors don't report

It's been known for many years that private physicians do not report all syphilis cases to the health department as required by law. However, the extent of such underreporting has not been known.

Now Dr. Arthur C. Curtis, chairman of the dermatology department, University of Michigan, has determined by questionnaire that only 11 percent of infectious syphilis, 38 percent of other syphilis and 11 percent of the cases of gonorrhea treated by private physicians during a three-month period were reported to the health department.

The advantage of reporting cases is the followup conducted by health authorities to learn if there are other infected contacts. This prevents further spread of the disease in the community.

The substance of youth

Female sex hormones are restoring a youthful zest to post-menopausal women whom nature has "short-changed" with premature aging by cutting down their supply of an important hormone.

For 21 years, women attending a clinic at the University of Chicago hospital have been taking a synthetic estrogen to replace that taken from them by nature.

They have shown a slowdown in physical aspects of aging and a protection against hardening of the arteries and heart attacks, says Dr. M. Edward Davis, who has directed the study.

"We began substitution therapy

when stilbesterol, the first synthetic estrogen, became available," says Dr. Davis. "We have 350 patients whom we have followed from five to 21 years. It can now be said with assurance that estrogens do not provoke cancer of the uterus, as had been commonly feared."

Nature has limited the reproductive period of women to about 30 years by shrinking the ovaries, thus reducing the supply of progesterone, the pregnancy hormone.

But in accomplishing this, observes Dr. Davis, nature also cuts down estrogen, the hormone that influences the elasticity of all the body tissues.

"In reducing the output of estrogen, nature is short-changing women," Dr. Davis comments. "Without estrogen, they begin to show signs of age. We feel now that these women can be helped physically and psychologically."

Electricity of life

Animals can be made to generate their own electricity and thereby power an internal stimulator needed to keep the heart beating at a regular pace.

If the technique can be extended to human beings, it will mean that patients who wear the so-called electronic pacemakers in their chest will not have to be subjected to periodic reopening operations to replace rundown batteries.

Pacemakers are electronic devices implanted in patients whose heart has a block in its electrical conduction system. As a result, the stimulus for initiating the heartbeat is not transmitted over the network to the heart muscle. Not only does the heart fail to beat at a normal rhythm, but it may beat so slowly as to endanger life.

Pacemakers stimulate the heart muscle to contract rhythmically, but they must be powered by batteries or external electrical sources. In developing an internal source of power, Dr. Victor Parsonnet of Beth Israel Hospital, Newark, N.J., uses a tiny device reminiscent of the early crystal radio. It maintains a self-perpetuating, biologically-energized heart pacemaker.

The crystals are hooked up to the aorta, the main blood channel leading from the heart. Each beat of the heart causes the aorta to pulsate. The pulsation produces a flow of current to the piezo-electric crystals. The electricity produced is conducted to the heart muscle to stimulate its beat.

Researchers at Mainomines Hospital have developed a method of controlling bladder evacuation in paraplegics by means of an implanted radio-physiologic stimulator.

The electronic device was built at the Avco-Everett Research Laboratory and consists of a tiny radio

receiver the size of a wrist watch and a small hand-held transmitter.

The receiver is placed under the skin on the left side of the abdomen. Two stainless steel wire electrodes, connected to the radio receiver, are implanted in the bladder muscle. The transmitter is held by the patient over the region of the receiver to transmit the stimulus causing bladder constriction and urine expulsion.

The idea of stimulating the bladder electrically as an aid to the estimated 200,000 paraplegics in the country has long intrigued medical researchers. Although the mortality rate in paraplegics with spinal cord injuries has been greatly reduced since World War II, more than half the deaths in this group are still attributable to complications involving the urinary tract. These complications include persistence of large amounts of residual urine in the bladder with subsequent infection involving the kidneys.

Do-it-yourself cancer test

At a cost of $2 per person, less than a visit to a physician's office, Dr. Howard J. Jones, Jr., of Johns Hopkins Hospital has uncovered 30 cases of curable cervical cancer in a year.

The system is to mail a do-it-yourself kit to women together with instructions on how to collect cervical cell samples. The samples are then mailed back to a laboratory for examination. Abnormal findings are reported to the woman's physician who arranges further tests and treatment, if necessary.

Cervical cancer is almost 100 percent curable in its early stage. Unfortunately, only about 15 percent of adult women visit their physicians for a smear test.

Dr. Jones, who also is medical director of the Maryland Cancer Society, is hopeful the simple and inexpensive mail kit will increase the percentage of women tested markedly.

Health problems of middle age

Almost nine out of 10 of the residents of Tecumseh, Mich., offered themselves as guinea pigs. It was the first broad and comprehensive study of health and disease in an entire natural population.

Here's what scientists at the University of Michigan's School of Public Health found in a preliminary way:

1. A fifth of the population above middle age suffered from high blood pressure.

2. An equal number had a high blood sugar level and a high serum cholesterol level.

3. A strong association between coronary heart disease and blood sugar levels existed, even in the absence of diabetes.

4. A striking climb, relative to age, was evident in the percentage of people above 50 who suffer from multiple health disorders.

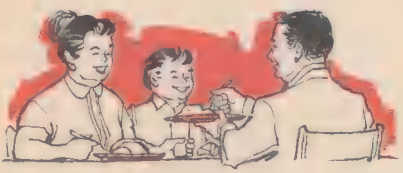
Among individuals in their 50's, the prevalence of coronary heart disease was 12 percent in men and six percent in women.

Rheumatoid arthritis affected one percent of the men in this age level and five percent of the women. Chronic bronchitis occurred in 11 percent of men and two percent of women; diabetes in two and three percent, respectively. There were many others in this age bracket classed as "suspected diabetics."

The perils of good eating

Child fat? Look to the parents for the reason.

Dr. S. L. Hammar of the University of Washington School of Medicine studied 50 overweight adolescents, ages 10 to 17, and found that 35 came from families in which both the mother and the father were markedly overweight.



The family eating patterns were deeply ingrained and could not be changed. In most cases, the mothers were excellent cooks and were always concerned about their children eating enough. The children had no idea of the amount of food they consumed.

Most boys and girls who are obese in adolescence retain obesity in adulthood.

Spotting the pre-diabetic

Might an individual who is destined to become a diabetic be identified early enough to prevent the illness?

If we had a biochemical test sensitive enough, this would be possible. Dr. Jerome W. Conn of Ann Arbor, Mich., believes such a test will come.

Diabetics have lost their capacity to handle carbohydrate foods normally, but this loss doesn't occur overnight. When the diabetes is first recognized clinically, says Dr. Conn, it is actually at a very late stage in the progression of events.

For a while the insulin-producing cells in the pancreas, even though working under strain, manage to turn out enough hormones for the body's needs.

But eventually, battle-fatigue catches up with the overworked cells. They have no reserve to overcome such influences as obesity or infection and the loss of ability to handle sugars becomes apparent.

A sensitive test would identify the beginning of the breakdown of carbohydrate tolerance.

The goal is to recognize the "pre-diabetes" state, before battle-fatigue catches up with the insulin-producing cells. Then it might be possible to halt the disease's progress.

Heat

HOW TO MELT ICE WITH ICE

At one time *heat* was thought to be a fluid and the name "caloric" was given to it. A piece of hot metal was supposed to differ from a cold piece because it had some of this fluid mixed with it.

In 1798 a scientist, Count Rumford, found that he could boil any amount of water by simply rubbing two pieces of metal together until they got hot. The same pieces of metal could be used over and over again, but they never lost the power of getting hot when rubbed, so that if they contained any "caloric" they must have an unlimited supply. Rumford therefore declared that no such fluid as "caloric" exists, but that heat is really a form of energy.

Sir Humphry Davy proved this by rubbing two pieces of ice together until they melted. Since the ice was cold to start with, it could not—according to the theory—have contained any caloric at all, yet it melted just as if it had been warmed.

Many years later, Joule found out exactly how much work, or energy, is needed to produce an accurately measured quantity of heat. He did this by stirring a small quantity of water very violently by means of paddle-wheels, until it boiled. He thus discovered the "mechanical equivalent of heat," which is about $\frac{1}{40}$th of a horse-power for 1°F. The manner in which energy can exist as heat was soon worked out.

All substances consist of tiny particles called atoms, and in most of them the atoms are grouped together in little clusters called molecules. Thus, a molecule of water is the smallest possible particle of water, and it consists of two atoms of hydrogen and one of oxygen (H_2O). In every drop of water the molecules are in constant motion; they are continually bumping against each other and bouncing off in new directions. Heat turns out to be nothing more than this energetic motion.

In a hot object, such as a lump of

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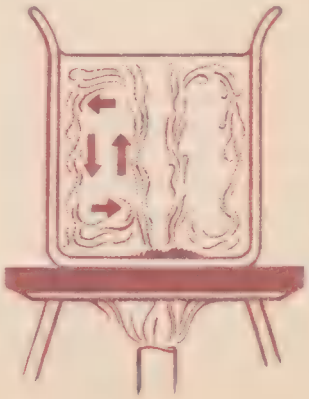
hot metal or a cup of coffee, the molecules are bumping about very violently and each of them undergoes several million collisions every second. Even in a cool room, where the temperature is about 65°F., the molecules of air are dashing about at the speed of rifle bullets, though they are so tiny and so close together that they travel only a minute fraction of an inch before colliding. The molecules in a block of ice shake to and fro much more slowly, but you can give them more energy by rubbing two blocks together, and then the ice melts because the molecules shake themselves free of one another (although they still remain very close together).

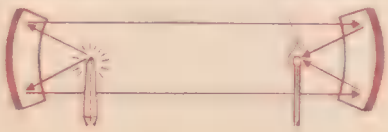
The unit by which heat is measured is called the "calorie," and it is the amount of energy required to raise one gram of water 1°C. Clearly it requires a lot of calories to raise a whole pint of water 1°C., and a lot more to raise a gallon 1°C., though when you have done it the pint and the gallon feel equally hot. This is because the energy of the molecules is the same in both cases, though there are more of them in the gallon than in the pint. The *temperature* of the water tells you how energetically the molecules are moving—how "hot" it is. The calories tell you how much total energy is required to set them all moving in this way. Thus, temperature is the *degree* of heat; calories are the *amount* of heat. A spark and a flame can have the same temperature, but the flame is bigger than the spark and so contains more calories.

We know that heat travels very readily along some solids, such as the metal of a spoon. Such a material is called a good conductor. Many metals, such as silver and copper, are very good conductors of heat. Other substances, like wood, wool and paper, are poor conductors. If you stick one end of a

Right: How convection currents move in a beaker of water when it's heated. Water at the bottom is heated, and rises to the top, and the cold water that takes its place is heated in turn.



Below: A simple experiment shows how radiant heat from a heated object, left, can be reflected by two mirrors (in much the same way as light) and ignite a match.



piece of wood in the fire it will burn, but the other end remains quite cool; but if you do the same with a poker, the handle soon becomes too hot to hold. The heat travels along the poker by conduction, which means that the violent bumping together of the molecules in the hot end soon disturbs the molecules farther along, and they play a game of "pass it on" until the molecules in the handle are also shaking violently.

The molecules in metals are arranged so that this takes place quite easily, but those in a piece of wood are of such awkward shapes, and so awkwardly arranged, that the motion soon dies away.

Watching the bump travel

When a locomotive shunts into a row of freight cars you can see—and hear—the "bump" travel along the row from one end to the other. But if all the cars were not on the rails, but were set at all angles across the track like a herd of cattle, there would only be an accident in the neighborhood of the engine. The cars would not "conduct" the bump for more than a short distance and those on the outside of the group would not even be affected. The cars on the rails make a good conductor of bumps, whereas those arranged at random make a bad conductor.

Sir Humphry Davy made wonderful use of the fact that wire gauze is a good conductor of heat in his invention of the miner's safety lamp. This lamp has an ordinary flame in it, but the flame is surrounded by wire gauze. This lets air into the lamp so that it can burn, and lets the light out so that it can be seen, but it conducts the heat of the flame safely and rapidly away so that dangerous gases in a coal mine will not catch fire or explode.

A cross made of four different types of metal with wax at each end. The rate at which the wax melts when heated indicates effectiveness of metal as heat conductor.

Use is also made of bad conductors of heat. Wool is a very bad conductor, and so we wear woolen clothes in the winter time to prevent the heat of our bodies escaping. Firemen and people who work where dangerous explosives are used sometimes wear asbestos clothing for the opposite reason. If there is a fire, the asbestos prevents the heat from getting to their bodies and causing bad burns. The doors and walls of ovens, furnaces and boilers are often lined with asbestos wool to keep the heat in, and exposed water pipes in houses are often covered with asbestos or old rags to prevent loss of heat in win-

ter, and the water in them from getting frozen.

When the molecules of a substance are shaken violently by heat they knock each other farther apart. This makes the substance grow bigger, and so we say that they expand when they are heated. For example, if a rod of brass which is a yard long at freezing point is heated to boiling point, it increases in length by about $\frac{1}{10}$th of an inch. This is not very much, but with large pieces of metal the effect may be very serious. Each section of Brooklyn Bridge, for example, is several feet longer on a hot summer's day than it is on a cold winter's day, and so the connections between them are made to slide in and out.

Expansion in a thermometer

Liquids expand with heat as well as solids, and the expansion of a small quantity of the liquid metal, mercury, is made use of in the thermometer. When it is hot the mercury expands and runs up the glass tube, its heights giving a measure of the degree of heat. Gases show the greatest degree of expansion, the volume of a gas being doubled when it is raised 273°C. Though thus increased in size there is still only the same amount of gas present; it is simply spread more thinly through the bigger volume. A cubic yard of hot gas is thus much lighter than a cubic yard of cold gas.

This was made use of in 1783 in the "fire balloon" of the Montgolfier brothers. They made a huge linen balloon with a very wide opening underneath it. They then supported the balloon over a bonfire until it was full of hot air, and released it. It rose rapidly for several hundred feet.

How warm air circulates

Now, air is a bad conductor of heat; but if you have a stove in a room the air soon gets warm because the hot air over the stove is continually rising, and the cold air moves in to take its place. This is heated in its turn, so that a circulation is set up and soon all the air in the room has been heated. Liquids are heated in the same way. When you put a kettle on to boil, the water on the bottom of the kettle is heated first. It expands and rises to the top, and the cold water that takes its place is heated in its turn. This process is called "convection," and it is how heat travels through all gases and liquids. It travels through solids by conduction, but through gases and liquids, which are bad conductors, by convection.

A hot object also sends out rays of heat. These are similar to light rays, but of too long a wave length to be visible. They are called "infra-red" rays, and when they reach our bodies they agitate the molecules in our skin and so we become warm. Heat can thus also travel by radiation, and that is how the heat of the sun reaches the earth across space.

KFS

REMEMBER?

Cars that ran on Oatmeal and Molasses

by T. M. Prudden

Early auto builders combined great ingenuity with great ignorance. Sometimes their creations even required the use of such unlikely substances as oatmeal, molasses, chopped feathers and horse manure.

SITTING, frozen-toed, trying to start your stalled car on an icy day, you may not think it's trouble free. But you must realize that cars have come a long way in the last half century.

A look backward to the auto as it used to be, is instructive as well as amusing.

The early cars were a slow evolution from horse-drawn buggies, and many early models had patent leather dash boards. The Holsman, International Harvester and Sears Roebuck cars had high buggy wheels. These were quite practical on the roads of those days, for the wheels would cut through mud to the solid ground beneath, as pneumatic tires would not.

Many mechanics, some of them blacksmiths, built cars, and most of them had no real knowledge of strengths of materials, or of the gas engine. One enterprising mechanic had ambitions for a super car—this was in 1909—and he coupled three Packard 4-cylinder engines together in tandem, one ahead of the other. It was an impressive power plant, but no good because each engine had its own timer (similar to the distributor on today's high tension ignition), and no two timers could be set in perfect relation to the others. Hence, one engine was always lagging behind or racing ahead of the others. Only a single timer could fire the twelve cylinders correctly.

Early builders would combine great ingenuity with much ignorance. The early Marion and Franklin had 4-cylinder, air-cooled engines, but they mounted their engines transverse of the frame and not fore-and-aft, with a sugar-scoop front end. Of course the forward side of the engine was cooled, but the after side would get dreadfully hot. The driver of any early air-cooled engine could judge how hot the engine was by the smell.

Roads didn't help

The roads of those days were a handicap to a successful car. It is almost impossible today to find a road as poor as a main road in 1908. They were dirt, and the dust raised even by a slow moving ox team was amazing. The designers of the Orient buckboard failed to appreciate this dust problem. They mounted their engine low down on the rear axle. As a result, the engine operated in a cloud of dust which was sucked into the carburetor and quickly clogged it, and the driver had to stop every few miles to take the carburetor apart to clean it.

Of course, dusters, goggles and veils were essential. Roads were repaired in the spring by scraping the turf from the side of the road into the center, thus filling ruts and chuck holes. But the first car over this road in wet weather would squash out this filling, exposing holes whose depth was hidden by dirty water. A wheel would drop into such a hole with a shocking jolt. Naturally, broken springs and axles were frequent. It seems doubt-

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A few cars had tires with inner tubes—"double-tube" tires they were called. Others had single-tube tires like some bicycles tires.

ful if even today's cars could stand the abuse of those early roads.

Builders did not have today's alloy steel and knowledge of heat-treating. One of Henry Ford's great contributions was his adoption of molybdenum steel, giving great strength to almost flimsy parts. The small size of the Model T front axle was an example and was in contrast with the cumbersome bulk of competitive cars. It was an axiom of many builders that if a part broke, the solution for greater strength was to put in more steel and make it heavier. They didn't know the rule that one pound of unsprung weight below the springs is as bad as three pounds above the springs.

It is doubtful if today's generation has any conception of how remarkable the Model T Ford was. We see them at antique car shows, and they are a laughable caricature of a car. But they would outperform most expensive cars of their day.

There were countless mechanics, each building his own idea of a car and some of them were better than Ford's first car. But Ford had the genius to foresee a light car—as did R. E. Olds of the toboggan-front Oldsmobile—and the unusual engineering ability to produce it cheaply.

Tires too hot to handle

Tires were a great handicap to general acceptance of the automobile. We get 30,000 miles or more from today's tire, but in 1909 a life of only 2,000 miles was to be expected. Tires were made with woven canvas rather than cord, and the internal friction of the constant flexing of the tire produced a lot of heat. After a three-mile run the tire would be so hot that it would burn your hand. They were expensive, too, perhaps $40 per tire. On any trip of twenty miles the driver could count on at least one flat tire,

and several spare tires and elaborate tube repair kits were always carried.

A few cars had tires with inner tubes—"double-tube" tires they were called. Others had single-tube tires like some bicycle tires. They were held on by four bolts passing through the rim into steel lugs vulcanized in the rim side of the tire. These tires were "hell and all" to repair when one had a puncture. The driver did not remove the tire from the wheel. He struggled with a pair of very long-nosed pliers to insert a rubber plug shaped like an enormous tack into the hole. The head of the plug, smeared with rubber cement, went inside the tire, then the shank was pulled taut—like an upside down mushroom—until the head of the plug was firmly bedded against the inside of the tire. It was held there with an aching hand until the cement had set, then the protruding shank was trimmed off. Try this once—try pushing a ½-inch diameter head of the plug through the tiny hole made by the puncturing nail, and don't forget how flabby and passively resistant a flat tire can be. Usually the puncture had to be enlarged to make the repair.

When a tire became really worn, down to the fabric that is, after a thousand miles of use, the owner didn't throw it away—tires cost too much. He took out the valve stem, filled the tire pump with a sticky mixture of chopped-up feathers and heated molasses, and pumped a cupful of this into the tire. Then he spun the wheel to spread the mixture uniformly around the inside of the tire. He had to hurry to get the spreading done before the molasses cooled and became thick. It was usually effective for a slightly porous tire. The molasses would be drawn by the escaping air into the pores, and the chopped-up feathers would seal them. The joker in this method became apparent if the tire sustained a sizeable cut or blow-out. Then the molasses, heated by the tire, would become very fluid and was thrown out by centrifugal force all over the driver and the landscape—the cunning little mud guards of the time being of little effect.

Inaccurate machining

In the "good old days" the machinery was not in existence for speedy, accurate machining of car parts. Gears for the modern car are ground to amazing accuracy. As late as 1912 the expensive Locomobile produced quiet gears by grinding them in, after assembly. The gear box was filled with oil and emery and the transmission run at high speed until the gears looked as though they had been sand blasted. This was typical of why a high grade car cost so much. All expensive cars were road tested, then pulled down and reassembled.

There was no standardization of threads on a bolt. You could rarely fit a ½-inch bolt of one car onto the ½-inch nut of another car. This made for difficulties in repair jobs.

The elimination of varnish for a finish was another of Henry Ford's

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Automobile bodies were not designed for any but fair-weather driving, and most cars were stored away for the winter.

great contributions to automotive development. Up to the time of the Model T, all cars were carefully varnished, perhaps even up to eleven coats, and hand rubbed between each coat, like a piano. Ford finished the Model T with one coat of spray-on, quick-drying, black paint. "You can have your Ford in any color you want, so long as it is black." It was drab but durable.

In one year Ford Motor Company turned out two million Model T's. That means 7,000 cars a day. If each car had been varnished only three times and it took one week to finish each car, there would be 42,000 cars in process. Where would anyone store so many cars? Quantity production would have been impossible without this change.

There were no gas stations, but some bicycle repair shops and even a few blacksmith shops sold gasoline. The careful driver carried his own reserve. All gasoline needs to be filtered to remove water—usually coming from the condensation of the air. Today's gas pumps have filters built into them and you don't see them. But in 1908, a driver carried his own funnel and a chamois skin for a filter. Chamois skin has the property of not letting water pass through if the skin has first been wet with gasoline. The experienced driver learned that emergency fuel could come from the always present oil side lamps. If there was enough gasoline to start the engine, then the kerosene from the lamps could be poured into the tank, and the engine would function—after a fashion.

Back in 1908 most radiators leaked—how could they help it after the pounding they took from the dreadful roads? A driver prepared for leaks. He had two methods of roadside repair. The foresighted carried with them uncooked dry oatmeal flakes. These, poured into the radiator, would be sucked into the leaks to swell and plug

them. The less provident relied on ever-present dried horse manure.

Cars were equipped with acetylene generators, handsome bulky, brass gadgets mounted on the running board. What a nuisance they were to keep dependable. The whole contraption had to be taken apart after each use even if it had only been needed for five minutes. It took several minutes after one was started for the water to drip down on the carbide and start the gas. And what a job it was on a windy night to light those headlight burners and close the lamp door before the wind blew out the flame. They would light with a pop, and the driver would race back to his generator to cut down the gas generation to a proper point.

Fair weather vehicles

Automobile bodies were not designed for any but fair weather driving, and most cars were stored away for the winter. There were no windshields on the earlier cars, and on the first Model T's the windshield was an extra. "Cape tops" came in early for touring cars but they were awfully drafty and a chore to erect. At least one car (the Pendleton) was equipped with a surrey top with a fringe around it. When closed bodies did come into general use about 1912, they were often loaded down with unnecessary luxurious gadgets such as cut-glass flower vases and silk roller curtains.

Of course, all cars were started by cranking, but those who fancied themselves expert mechanics could usually start their cars (after a short stop) "on the spark." This applied to cars with dry batteries and induction coils for each cylinder. If the valves and cylinder head were tight enough, the charge of explosive gas would be held for an hour or more. Then by turning on the switch and moving the spark lever until the timer made a contact, one cylinder would be fired. (A spark lever is an unknown control on today's car, but the owner of a Model T will know it.)

The hazard of cranking

Broken arms from back-firing when cranking were common. However, there were two safety techniques; one was to crank with the left hand, and the other was to use the right hand but not place the thumb around the crank. Try this last with any crank. They were both very awkward, and made it almost impossible to spin the motor, and all top-notch mechanics could spin their motors. It was a knack of throwing the weight of the shoulders into the downpush rather than brute strength.

It is hard to believe today the jeers that an automobilist had to submit to. When a man was straining to diagnose engine trouble or sweating to repair a tire, it was intensely irritating to have a fresh young kid dash up to yell, "Get a horse," and then dash back to approving, grinning bystanders.

We have come a long way.

Coming: new birth control measures

by Herbert G. Lawson

- The "once-a-month" pill
- The pill that meets Catholic objections
- A device that is good for four years
- Contraceptive injections for men

THE competition among U.S. drug makers to perfect a better birth control pill is reaching a fever pitch.

For the winner in this multi-million-dollar research battle, the stakes are high: A market that may eventually encompass tens of millions of women world-wide. From a broader viewpoint, the race to develop cheaper, safer and simpler contraceptive drugs may bring a solution to the "population explosion" that even now is canceling out productivity gains in many underdeveloped areas.

At least 10 U.S. pharmaceutical companies have entered the race to develop new pills. "Any company of any size is now in the field or looking for licenses in order to enter it," says Dr. Henry Strade, vice president for medical affairs of Organon, Inc., a West Orange, N.J. drug maker.

G. D. Searle & Co., which pioneered birth control pills with Enovid, is applying for Federal Food and Drug Administration approval of a new compound, Ovulen, in a one-milligram pill. If the FDA clears it, Ovulen would probably be the cheapest pill on the market, Searle asserts. Another pill given FDA okay—Ortho-Novum, made by Ortho division of Johnson & Johnson—has stolen the price lead from Enovid. Ortho's new two-milligram pill generally sells for $2.25 for a month's supply, 65 cents less than the smallest Enovid dose yet approved.

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In a Catholic hospital in New York City, student nurses are volunteering for the first studies of how an Upjohn Co. birth control drug affects basic body chemistry. Later the drug will be tested with married women to see if it can prevent unwanted pregnancies. The company hopes the drug will overcome objections of the Roman Catholic Church to oral contraceptives. The drug would be used to "guarantee" effectiveness of the rhythm method of birth control approved by the church.

In Israel, a researcher at Weizmann Institute of Science, is beginning studies in women of a totally new type of birth control pill which, animal experiments suggest, might provide contraception with one pill a month instead of 20, as is now required.

Cheaper and safer oral drug

In cities such as San Antonio, Columbus, Ohio, and Mexico City, a new concept of oral contraception, involving two drugs taken in sequence during the month, is proving effective in tests. Its developers —Eli Lilly & Co. and Syntex Corp. —are betting that it will be cheaper and safer than anything presently in sight.

Not all these promising experimental drugs may reach the market. But scientists are confident that, as understanding of the human reproductive process increases, improvements in birth control pills are inevitable.

The era of oral contraception began in 1960, when Searle's Enovid was first marketed. Extensive clinical trials had shown it to be nearly 100 percent effective. Enovid is a combination of synthetic female hormones similar to natural hormones called progesterone and estrogen. These hormones can suppress ovulation by inhibiting substances from the pituitary gland that normally trigger release of the egg.

Almost 2 million users

Enovid originally cost $10 for a month's supply of 10-milligram pills. But the cost steadily dropped as researchers found smaller doses were as effective as the larger pills. The smallest Enovid pill on the U.S. market, 5 milligrams, costs about $2.90 for a month's supply. Some 1,750,000 American women take oral contraceptives regularly, about 90 percent of them Enovid users, Searle estimates.

The drive for wholly new kinds of drugs is intense because of several disadvantages of present Enovid-type pills. "We're a long way from the ideal pill," declares Dr. Edward Tyler, a pioneer clinical researcher in oral contraception at the University of California at Los Angeles.

The major drawback of pills presently in use is their cost. In underdeveloped areas where the need is most urgent and the market potential greatest, "the price is still far too high," says Franklin O'Brien,

Searle vice president. World-wide users of the pills total only between two million and three million, he estimates.

Governments of nations with high birth rates are doing little to underwrite costs of oral contraceptives, adds O'Brien. One exception: A pilot program now under way in the United Arab Republic. But drug executives are heartened by a recent action of the Senate Foreign Relations Committee. It tacked an amendment to the current foreign aid authorization bill which specifically allows the U.S. to supply birth control information to nations receiving aid.

The question of safety

Aside from the present high cost, birth control pills also must overcome questions raised about their safety. Dr. Roy Hertz, a top National Cancer Institute scientist, said recently that the estrogen component of the pills may cause breast and uterine cancer.

But many other scientists take an opposite view. They note that Dr. Hertz's concern is based largely on experiments on mice, in which estrogen can produce tumors. In actual use with women, Enovid seems to prevent cancer. Comparisons of Enovid users in Puerto Rico with other women of similar age indicates almost 10 times as much uterine cancer among non-users.

A second, and perhaps more persistent, question is whether the use of Enovid-type pills can cause serious and sometimes fatal bloodclotting disorders. A committee of university scientists recently studied Enovid-linked clotting disorders for the FDA, but its findings neither proved nor disproved the suspicion. Further studies are under way by such groups as the Planned Parenthood Federation of America, a private group that sponsors birth control clinics.

If doubts over safety of oral contraceptives are dispelled, their use still might be limited by new nondrug contraceptives. The most promising are several types of plastic ring-shaped devices, which are inserted by a doctor into the uterus. Unlike diaphragms, the plastic devices do not block the entry of sperm. Doctors concede they don't know exactly how the devices work, but it may be that they function by changing acidity or other chemical factors of the uterus. The ring remains implanted until the woman wants it removed. Some have been in place without difficulty for four years or more.

Dr. Jack Lippes, a Buffalo gynecologist who is the medical director of his city's Planned Parenthood clinic, developed one variety of the new plastic inserts. He says it costs about 10¢ now and could be cheaper if mass-produced. The only other cost is insertion. Doctors charge anywhere from $25 to $100 for the procedure for patients who can afford it. Dr. Lippes notes it could be done by a nurse in countries short of doctors. The painless office procedure takes only a few minutes.

One chemical compound shows promise of stimulating ovulation within a precise period after a pill is taken. It might be acceptable to Catholic doctrine, and eliminate the need for temperature charting.

Dr. Lippes maintains the uterine plastic devices are "more effective than pills." In about 1,800 women who tried the devices the pregnancy rate was less than 1 percent. Side effects, such as bleeding or pain, were serious enough to force discontinuance by 5 percent to 6 percent of the women.

Dr. Lippes' device and similar ones developed by Dr. Lazar Margulies of Mt. Sinai Hospital in New York and Dr. Charles Birnberg of Brooklyn are still considered experimental. If current success with them is confirmed, they will be submitted to the FDA for approval and a manufacturer will be sought to produce them, Dr. Lippes indicates.

Pills easier to distribute

Despite the optimism of proponents of the plastic ring devices, drug industry scientists consider them relatively unproved, especially for long-term use. Also, pills ultimately might prove simpler to distribute among large numbers of women in such places as India and South America.

Upjohn's efforts to overcome Catholic objections to birth control pills—something the developers of Enovid-type pills have been unable to accomplish—are likely to arouse special interest. Now the only method of birth control sanctioned by the Catholic Church is abstinence during fertile periods of the menstrual cycle. Catholic women practicing this rhythm method must chart daily temperature changes to determine when ovulation occurs.

The Upjohn compound, whose chemical composition has not been disclosed, shows promise of stimulating ovulation within a precise period after a pill is taken. Thus, it would eliminate the need for temperature charting, an uncertain and time-consuming method. Upjohn officials believe such a pill would be acceptable under Catholic doctrine, although the church itself has not yet been faced with making a decision on the matter.

Two other Upjohn compounds also might provide new approaches to contraception. One is a drug, Dihydrodiphenylnaphthalene, which works differently from any present pill to block conception. In four animal species tested, it appeared to speed the egg through the fallopian tube so fast that conception, which normally occurs in the tube, was prevented. First human clinical trials are now under way.

The other Upjohn compound is Depo-Provera, a hormone drug now

used to treat various female disorders. Upjohn scientists, in early clinical trials, found that Depo-Provera acts as a male contraceptive by blocking sperm production. If further trials support early results, "a single injection might provide several months infertility," says Dr. Gilbert McMann, Upjohn's assistant director of clinical investigations.

At Weizmann Institute in Israel, Dr. M. C. Shelesnyak is beginning studies in women of the effects of ergocornine, an alkaloid drug produced by Sandoz S.A., Basle, Switzerland. Animal experiments indicate that one pill during each menstrual cycle could prevent conception. "With lots of luck, we'll be prepared to begin field trials in two or three years," he says.

The new Lilly-Syntex approach to contraception, in which two drugs are used in sequence, is much further along in clinical development. An estrogen-like drug is taken starting on the fifth day of the menstrual cycle and continued for 15 days; then a new progesterone-like drug, called chlormadinone, is taken for five days.

This "sequential therapy" results in far less progesterone intake than in present birth control pills. Since the progesterone component is by far the most expensive part of the pill, the Lilly-Syntex approach should mean lower monthly cost, one industry observer notes. The method proved effective in more than 900 women tested.

The big birth control push is on, and this frantic research effort should have some dramatic results in the near future.

How a condemned man can help

How can we know which of us has a tendency to heart disease? Two medical investigators think that a study of condemned criminals may show if this ailment is predictable.

Myron Prinzmetal, M.D., and Constance Prinzmetal point out in a recent *Journal of the American Medical Association* that most heart attack predictions are based on the study of various types of blood fats, although other factors, such as body build and heredity, are considered relevant. The validity of such tests, however, has not been established, and proposed ways of evaluating them are too expensive or difficult to interpret.

The Prinzmetal's believe that an autopsy study of executed criminals might provide "an early and relatively inexpensive answer. . . ."

They suggest that condemned criminals have complete histories taken, including data on familial history of vascular disease, diet, exercise and psychic factors. Thorough physical exams would be followed by routine tests. Photographs for anthropological typing would also help.

Next, blood samples would be sent to scientists who have proposed specific tests for making the predictions. Finally, a central committee would make a statistical evaluation of the autopsy findings and the test results.

Science in the news

Scientists have been probing the mysteries of the universe to mind-reeling distances.

Soviet astronomer Iosif S. Shklovsky used a spectrum obtained with California's Mount Palomar telescope to calculate the distance of a celestial object known as 3C-286. He found that it is (or was) 10 billion light-years away. At 186,000 miles a second, its light has been traveling 10 billion years. Even our solar system isn't that old. Other "quasi-stellar" objects discovered recently have been figured to be upto 5 billion light-years away. CIT's William Fowler says 11 such objects have been discovered so far. Their presence was detected by the radio waves they emit. Then optical telescopes got a look at them and obtained their spectrums.

Study of their spectrums reveals their distance on the basis of Hubble's Law, named after America's Edwin P. Hubble. He figured that the faster galaxies recede from us, the farther their light shifts into the red end of the spectrum.

Equally astonishing discoveries have been made by so-called rocket astronomy. Rockets carrying X-ray detectors have determined the

existence of stars that are believed to be made up entirely of neutrons. The neutrons are packed together so tightly, they're thought to weigh between 10 and 100 billion tons per cubic inch. That would make the neutron stars more "solid" than any other objects we know about. They may weigh as much as our sun but scientists figure that they are only five to 10 miles in diameter.

Our own prosaic moon acted up recently in startling fashion. On two occasions, the Lowell Observatory in Flagstaff, Ariz., saw red glows near the crater Aristarchus. The sightings confirmed a previous report by the Soviets' Nikolai A. Kozyrev of a brightemission on the moon's surface. Harold C. Urey, a lunar expert, believes water may act on calcium carbide beneath the surface to release acetylene gas which sunlight then breaks down. Whatever the explanation, we know now that the moon isn't dead.

Elsewhere in our solar system: Russia set a new distance record for radar by bouncing signals 370 million miles to Jupiter and back....We sent up Tiros-8, a weather satellite that promptly started sending sharp pictures of cloud and storm patterns from 400 miles up....NASA reported 25 orbital shots over a two-year period and 25 successes. Only one of the 25 failed to function once it was up....Our plans to land instruments on Mars faced sharp revision after a study showed its"air" too thin for 'chutes.

Cigarette smoking, in case you haven't heard, was condemned by the Federal Government. A committee under the Surgeon General said cigarettes contributed substantially to the death rate, principally by causing lung cancer. But the committee's report was not wholly negative. It said, "Medical perspective requires recognition of significant beneficial effects (which) originate in a psychogenic search for contentment." In prospect: better filters, smoke-quitting clinics, tobacco substitutes, a big switch to cigars and pipes.

Wisconsin U.'s Waclaw Szybalski reported a possible new way to fight cancer. He found that mitomycin, an antibiotic, may stop the growth of cancer cells by tying up their DNA --the material that determines how cells function. A big "if": Mitomycin may also tie up the DNA of normal cells.

MEDICAL SHORTS: Researchers at Pontiac, Mich., General Hospital successfully used the blood of human corpses for transfusions to living people.... U.S. public health officials urged revaccination against smallpox for fear that an outbreak would get out of control (only one American in four is said to have the proper immunity)....Brooklyn gynecologist Robert A. Wilson prevented the menopause in 139 women by administering the female hormones, estrogen and progesterone, in controlled doses.

The Administration and the Congress squared off again on the space program. Johnson is asking legislators for $5.3 billion for NASA in the coming year--$400 million less than requested last year. But he's also asking Congress to cough up $141 million to make up for the $600 million cut it made in NASA's budget last year. A spokesman for the agency said, "We are really crowding the end of 1969." That's the year the U.S. is committed to send a man to the moon.

It's now official: Our nuclear arsenal is big enough for us to start cutting back the production of nuclear materials. The output of enriched uranium, LBJ announced, will be cut 25% in fiscal 1965. And four of the AEC's 14 reactors producing plutonium for warheads will be shut down. The President's objective: to avoid "an excess of military power that could be provocative as well as wasteful." Administration officials say we have "tens of thousands" of nuclear weapons now. Meanwhile, the U.S. and Britain are competing to sell $20 million worth of plutonium to West Germany and France for peaceful uses.

U.S. cities may be divided into "smoking" and "no smoking" zones. Minnesota U.'s Francois N. Frenkile suggested the zoning as a way of controlling the pollution of air in our cities. California public health officer John R. Goldsmith said the carbon monoxide level in L.A. has been rising 10% a year.

If you can't say magnetohydrodynamics, say MHD. That's the name of a method of generating electricity that has research scientists working overtime. It involves passing a stream of hot ionized gas through a magnetic field. A difficulty, if the gas is hot enough: it melts the whole apparatus. Martin Marietta Corporation of Baltimore believes it has overcome the difficulty by a process that heats the free electrons in the ionized gas but not the gas itself. But it says the practical use of MHD is five or 10 years off.

Look for a shift in U.S. thinking on our strategic striking force. Bomber production has been at a standstill since 1962, when the last B-52's and B-58's came off the production lines. We've been testing the B-70, but with poor results, and have concentrated the while on building better missiles. But a lot of people are unhappy at depending on weapons untested in war. Now it looks as if Defense is ready to try for another bomber. One report says officials may completely reverse the trend of recent years by choosing a plane that's supersonic and flies high but delivers its punch at tree-top level.

INCIDENTAL FACT OF THE MONTH: Of the 11 members of the U.S. panel on smoking, five don't smoke, one gave up smoking 13 years ago, two smoke cigarettes, one smokes cigarettes and pipes, one smokes cigars, one smokes pipes and cigars.

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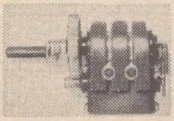

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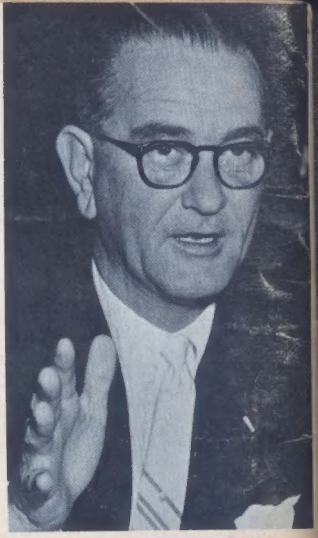
The diesel that replaced the cow

SINCE antiquity, well water along the dry coast of Libya has been raised in a dalu, or goatskin bucket. The heavy water-filled bucket was lifted by the combined efforts of a man and a work cow (above). This picturesque but slow method of irrigation is now giving way to the diesel pump (right), powered by Libya's own recently discovered oil. How now, brown cow?

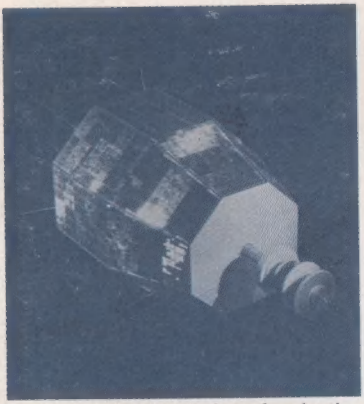
In this issue . . .

This tiger, believe it or not, is better off behind bars. He'll live longer, be healthier and eat better than his brothers in the jungle. Why? Because he lives in America's largest zoo, whose men have a wide range of skills in the care and feeding of wild animals. For a picture story of how they tend their charges at the Bronx Zoo, from tigers to hummingbirds, see page 43.



Somewhere in the Atlantic is the U.S.S. Northampton, a ship designed especially for the President of the U. S. It contains the most up-to-date communications equipment in the world. One section of the ship is under such tight security that even the ship's captain can't go into it without special permission. Despite the elaborate facilities of this "floating White House," it is a ship the world hopes the President will never have to use. See page 52.

This little girl is doing a bit of premature bird watching. She won't be disappointed, the bird will be along shortly. You won't be disappointed either in the delightful Easter picture story starting on page 8.



The first flush of enthusiasm for shooting things into space is clearly over. Now taxpayers are beginning to look at those expensive satellites and ask, "What practical value does it have? Am I getting my money's worth?" The story of a space project that really makes sense starts on page 56.

The Patent Office has been caught by the explosion of scientific development, and searching a patent has become like looking for a needle in a very large haystack. A veteran Patent Office observer reports on the reasons for this ever-increasing problem and some of the possible solutions to it on page 65.